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REPORT OF CHIEF OF BUREAU OF BIOLOGICAL SURVEY

UNITED STATES DEPARTMENT OF AGRICULTURE,
BUREAU OF BIOLOGICAL SURVEY,
Washington, D. C., September 18, 1924.

SIR: I have the honor to submit herewith a report of the operations of the Bureau of Biological Survey for the fiscal year ended June 30, 1924.

Respectfully,

E. W. NELSON,
Chief of Bureau.

Hon. HENRY C. WALLACE,
Secretary of Agriculture.

GENERAL ACTIVITIES AND ORGANIZATION

The work of the Bureau of Biological Survey has to do with the conservation of the useful and otherwise valuable wild bird and mammal life of the country, including species classed as game and as fur bearers. This involves the administration of certain Federal laws, including among others the migratory bird treaty act and laws for the protection of land fur animals in Alaska. The bureau is charged also with the duty of controlling certain species which, through their feeding habits or excessive increase in numbers, have become seriously injurious to agriculture, including many kinds of crops, horticulture, forestry, and stock growing on the western ranges. In addition, with its efforts to conserve and build up the wild life of Alaska, the bureau conducts investigations and experiments to develop the reindeer industry, and to utilize some of the numerous islands in the Great Aleutian Reservation for stock-growing purposes. These activities are all based on scientific investigations, which include extended field and laboratory studies.

The only change in organization during the year has been the separation of the section having to do with the development of fur production, including fur farming, from the Division of Economic Investigations, and its establishment, effective July 1, 1924, as the Division of Fur Resources, in charge of Frank G. Ashbrook.

The work during the year was conducted under six divisions, as follows:

1. Economic Investigations, Dr. A. K. Fisher, in charge. Necessary investigations of injurious wild mammals and methods for their control are conducted by this division and the leadership and organization furnished for cooperative and other campaigns against predatory animals and destructive rodents throughout the country. Through experiments in fur farming, and in other ways, studies have been made of problems in fur production and the development of the fur industry.

2. Food Habits Research, W. L. McAtee, in charge. In this division are investigated the food habits and economic relations of birds, reptiles, and amphibians, the food resources of water areas for migratory wild fowl, and methods of control of injurious birds, and basic recommendations are made in these particulars.

3. Biological Investigations, E. A. Goldman, in charge. Field and laboratory studies are made of the wild life of the country, including mammals, birds, reptiles, amphibians, and the more characteristic native plants. This includes technical investigations

to determine the classification of species, also their life habits and distribution, including the migratory movements of birds, for the purpose of mapping the natural life zones of the country and of supplying fundamental scientific information as the necessary basis for the economic, regulatory, and other activities of the bureau.

4. Alaska Investigations, the chief of bureau and W. F. Bancroft, in charge. All problems affecting the improvement and management of reindeer herds are studied in this unit; fur production is encouraged through advice to fur farmers and the enforcement of laws and regulations for the protection of land fur animals in the Territory; and possibilities of utilizing certain islands for stock grazing are investigated.

5. Game and Bird Refuges, Smith Riley, in charge. This division supervises the maintenance of 69 Federal large game and bird refuges and the warden service on them, including the production of hay for feeding elk on the Winter Elk Refuge at Jackson, Wyo.

6. Migratory Bird Treaty and Lacey Acts, George A. Lawyer, Chief United States Game Warden, in charge. Under this division are administered laws for the protection of migratory game and other birds, and laws governing interstate shipments and importations from abroad of wild birds and mammals.

WILD ANIMAL PESTS

The widespread destruction by such stock and game killing animals as wolves, coyotes, mountain lions, and bobcats, as well as by the numerous crop, forage, and tree damaging rodents, including prairie dogs, ground squirrels, pocket gophers, rabbits, and others, especially in the Western States, has resulted in defensive organizations on a large scale to limit the losses from these sources. A constant, desultory warfare had been conducted against these animals by the payments of bounties and otherwise since early in the occupation of this continent by Europeans, and the lack of results from such sporadic efforts was amply demonstrated. As a result, during the past 10 years there has been a steady growth of correlation of Federal, State, and local efforts. Well-organized campaigns have resulted and have been vigorously conducted during the past year.

For the destruction of these wild-animal pests on the public domain and for cooperative work elsewhere during the year, an appropriation of $447,666.42 was made by Congress. Of this sum, $287,951.81 was used in the destruction of predatory animals and $159,714.61 for the control of rodents. The work was conducted in 19 of the Western States and several Eastern States, which provided cooperative funds totaling $894,922 either by direct State appropriations or from other sources. Approximately $387,424 of the cooperative funds was expended for the destruction of predatory animals and $507,498 in the rodent-control campaigns.

The general range of most of these animal pests has been determined. The fierce destructiveness of large wolves and of mountain lions, both to domestic animals and game, is so great that it becomes a necessity to eliminate them from certain areas. This, however, does not mean the actual destruction of these species, since they range over such a vast area in both North and South America that the possibility of their actual extermination undoubtedly lies many centuries in the future.

The coyote is one of the most widespread of all predatory animals and is so numerous in the aggregate that it is probably the most destructive of them all, both as to domestic stock and game. Enormous numbers of coyotes are killed each year, but they have so many young to the litter that, except in restricted areas, little more than the increase is destroyed annually. In parts of the West, however, the campaigns against them have materially reduced their numbers.

The effect of this reduction in the numbers of coyotes is well indicated by a marked decrease in losses of sheep and other livestock and by a very notable increase of game, including such ground-nesting birds as the quail. Coyotes are so cunning and adapt themselves so readily to changing conditions of environment, including the warfare against them by man, that they are showing as great persistence in maintaining themselves as the red fox, which still occurs in the eastern United States despite the centuries of pursuit by its human enemies.

The big wolves have been reduced to a relatively small number over much of the West. Since 1915 more than 5,400 of them are known to have been

killed, in addition to many which have been poisoned and not found. In northern Mexico, Canada, and Alaska these animals still occur in considerable numbers and will long persist as picturesque elements of the fauna. They will undoubtedly continue to invade the United States along the border for a long time in the future and only vigilant efforts will prevent them from reinfesting vast areas where the losses caused by them are now bringing about their destruction.

The numbers of both predatory animals and harmful rodents depend mainly on the food supply. The general distribution and abundance of livestock, together with widespread crop production, furnishes so dependable a food supply that, without organized control work, the aggregate losses from these pests would become appalling and successful stock growing and agriculture would become impossible over great areas.

The success of the long-continued educational work of the bureau to bring the public to a realization of the heavy annual losses from house rats and the possibility of eliminating most of them at a reasonable cost is becoming evident. Appeals for aid to control these pests have come from 45 States, and as much assistance as possible has been given with the men and funds available, and experts of the bureau have aided in organizing more or less extensive campaigns in 22 States.

The hearty cooperation of States, local organizations, and individuals has made possible the systematically conducted operations under the leadership of bureau representatives for the control of the various destructive animals. In addition to the funds contributed, more than 66,000 farmers and stockmen took active personal part in the rodent field work, contributing time and labor in operations on Federal and State lands as well as on their own holdings. Thousands of farmers and stockmen joined in the organized work of trapping and poisoning coyotes, and this has added greatly to its scope and effectiveness and made it possible to conduct operations at a minimum cost to the public.

PREDATORY ANIMALS

Field work against predatory animals was conducted during the year in Arizona, Arkansas, California, Colorado, Idaho, Michigan, Missouri, Montana, Nevada, New Mexico, Oklahoma, Oregon, South Dakota, Texas, Utah, Washington, and Wyoming in cooperation with organizations and individuals. State agencies participating included departments of agriculture, livestock commissions or boards, game commissions, extension departments, county organizations, and stockmen's and farmers' associations. Cooperating Federal agencies that control areas of Federal lands included the Forest Service of the Department of Agriculture and the Office of Indian Affairs and the National Park Service of the Department of the Interior. The Bureau of Plant Industry and the Bureau of Chemistry of this department also have aided in consultations and laboratory investigations, and the survey field men have effectively cooperated in operations of the Bureau of Animal Industry to eradicate foot-and-mouth disease in California, which is not only destructive to domestic stock but also is a menace to deer and other hoofed game.

In addition to the thousands of cooperating stockmen a force of 406 trappers and poisoners was employed under bureau supervision during the year. Part of the men employed were paid from Federal funds and part by the States and other cooperating agencies. Skins or scalps of 38,591 predatory animals were taken, of which 562 were wolves, 34,092 coyotes, 3,507 bobcats and Canada lynxes, 237 mountain lions, and 193 bears. In addition to these animals, it is estimated that about 100,000 coyotes were killed in the extended poisoning operations, of which neither skins nor scalps were taken. Bears are regarded as game animals, and the official hunters have strict instructions not to kill them except individuals known to be destructive to livestock.

State game departments and sportsmen's associations in many States have cooperated heartily in the predatory animal work on account of its very evident favorable influence on the game supply.

Wolves.—When the organized work against predatory animals was started in 1915, wolves were regarded by cattlemen and other experienced observers as the wild animal by far the most destructive to livestock. Wolves had previously subsisted on buffalo, elk, deer, and other large game animals which they were able to pull down individually or by operating in packs. The development of the livestock business throughout the West afforded them an abundance of readily obtainable food among the calves, yearlings,

and even adult cattle, sheep, swine, and other domestic animals. Despite enormous sums paid in bounties on predatory animals, which sometimes almost bankrupted counties, and the great but unorganized efforts of ranchmen and their employees and of professional trappers, wolves maintained themselves in large numbers and exacted a heavy toll from the livestock industry. In some districts they rendered impossible the growing of sheep and hogs. Economic pressure due to restricted ranges and the necessity for closer attention to every item that reduced the margin of profit finally made intolerable this drain upon the possible output of livestock.

Inauguration by the Biological Survey of carefully planned organized operations and constant improvement of methods through investigations conducted by trained experts have made possible effective headway toward the extermination of these exceedingly destructive animals in livestock-producing areas. Concentrated efforts have been made to take promptly the more notoriously destructive individuals. Already 5,478 wolves have been destroyed and their skins or scalps secured. Many others are known to have been killed by poison, and in addition, numbers of pups and unborn young have been accounted for. In many sections where wolves formerly occurred in packs of 12 to 15, not a sign of a wolf has been seen during the past two or three years. These animals have disappeared from their well-known ranges following the placing of poison about their haunts, and have become so scarce that in a number of instances solitary wolves have been detected trying to lure dogs away from ranches as mates. This is not infrequently successful, and the hybrid young resulting often prove to be notoriously destructive animals.

One female wolf in Arizona that had been endeavoring to lure away a ranch dog was killed within 30 yards of the door of the ranch house through poisoned baits. Few young wolves have been permitted to escape during the past two or three years, and the adults that now remain are, for the most part, wily individuals that have thus far evaded capture by exercising extraordinary cunning. Throughout most of the western range country the losses from wolves should be practically eliminated in the near future.

The wolves crossing the international boundary from Canada and Mexico into the United States present an international problem that will be difficult to solve. Of the 22 wolves killed in Arizona during the past year, 17 had recently crossed from Mexico. Of 39 wolves killed in New Mexico, 19 were taken by one hunter close to the Mexican border. This hunter, after returning to a locality which had previously been cleared of wolves, in two days found 14 calves killed and 21 mutilated by wolves which had crossed the border. Some cooperation has already been secured from American ranchmen in Mexico. They have worked in consultation with our leaders in border States and report having taken 70 wolves during the past two years.

Notable kills during the year include an old white wolf in Arizona, known for the past eight years on the Aguila range and reported by stockmen to have killed about $25,000 worth of cattle and sheep in that time. On one occasion this wolf was definitely known to have killed 65 sheep in one night and 40 in another. It averaged a calf about every four nights. Coyotes had learned to follow this old wolf, sometimes as many as 12 or 15 at a time, in order to feast on the leavings after it had made a kill. Stockmen had placed a bounty of $500 on its scalp, and many private hunters and trappers had worked for it months at a time without results. Its range was most unusual for a wolf, being in the low, hot desert at an altitude of not more than 3,000 feet above sea level and in a district overgrown with the typical desert vegetation, such as palo verdes and mesquites. This wolf succumbed in October to skillfully placed poisoned bait distributed by one of the cooperative Federal-State hunters.

A wolf locally known by forest rangers and stockmen as the "butchering wolf" was trapped in Eagle County, Colo., during July, 1923. In addition to its record of animals killed outright it had an unusual reputation for biting off the ears and tails or otherwise mutilating young calves and even full-grown cattle. The hunter who was detailed to the task of getting this renegade rode thoroughly over the country, noting signs where the animal ranged, and then carefully placed his traps. On his first visit to these traps he found the wolf awaiting him in one of them. The head of this wolf was mounted and now adorns the office of the State Board of Stock Inspection Commissioners in Denver, this board being the cooperating agency in Colorado.

A notorious she wolf was taken in December south of Pueblo, Colo., which had been known for a long time in that section and was responsible for the killing of many cattle. The hunter rode the range frequented by this wolf and succeeded in killing it within three weeks. It had been in traps several times previously, but had escaped, losing a toe on each front foot. The wounds had healed so completely as to give the appearance of a naturally three-toed animal. The manager of the ranch on which this wolf was taken writes:

> I am taking this means to thank you for the services of your hunter in this neighborhood for the last two months. While there may be a few coyotes left, he has reduced them greatly in number, and it is a great satisfaction to know that we are rid of probably the last wolf in this part of the country.

A hunter north of Fruita, Colo., finally succeeded in December in trapping an old wolf with seven unborn young. It had preyed heavily on deer, cattle, and sheep in the section, and its dens had yielded the trappers a total of 21 pups in three consecutive years.

In one locality along the Oklahoma-Arkansas border, where no predatory-animal work had previously been done, 14 wolves were killed within a few days during October on an area less than 10 miles square, 11 being poisoned and 3 trapped. These wolves appeared to have a rather extensive range, and their depredations were heavy on calves, colts, and hogs, especially hogs, practically all of which had been destroyed by them in several neighborhoods in both States.

In southwestern Missouri 93 wolves were killed during the year the work has been in progress. In northern Michigan, where the work has been in progress for three years and where wolves have been very materially reduced in numbers, a hunter discovered signs that a small pack of wolves had recently passed. Four traps were set close together, and the following morning the trapper was rewarded by finding an adult wolf in each.

Coyotes.—At present coyotes, which in the aggregate in the United States must number several million animals, are unquestionably the most destructive predatory animals in this country. One of the most difficult problems of predatory animal control is raised by them. They are widely distributed and well endowed by their mental qualifications to protect themselves and secure food under a great variety of conditions. To insure their perpetuation they are prolific breeders, sometimes having 14 young in a litter. Contrary to their former habits, coyotes may now be found throughout high and rugged mountain ranges and in dense forests.

Not only have they occupied practically all the available territory in the Western States, but they have moved northward into Alaska and to the delta of the Mackenzie River in Canada. They have successfully maintained themselves in such States as Illinois, Indiana, and Michigan, and continually invade new territory.

Coyotes persistently follow livestock and game in their seasonal movements between summer and winter ranges, constantly preying upon the young and even adult cattle, sheep, goats, and swine, and deer and antelope. Coyotes are also notorious destroyers of the eggs and young of ground-nesting birds, including such important species as sage hens, prairie chickens, quail, grouse, and many kinds of ducks. They also destroy great numbers of full-grown birds and are probably the most seriously destructive enemy of our game resources. Because of their foxlike skill in concealing themselves and in escaping pursuit, they often successfully locate their dens and rear their young in close proximity to ranches and farms. A recent study of denning activities in a limited area surrounding a single ranch revealed a group of 8 coyote dens, from which 48 pups were taken.

It has long been recognized by the Biological Survey that the only hope of coping successfully with these animals is through the development of effective poisoning procedure and its application on a wide scale throughout their range. With this in view, constant effort has been made to devise poisoning materials that would prove palatable and not arouse the suspicion of these alert animals and to devise methods of distributing poisoned baits in such a way that the infested area might be systematically covered.

Successful plans of organization and vigorous prosecution of the campaigns, including the use of these improved methods of poisoning, supplemented by a limited amount of trapping, shooting, and den hunting, have made remarkable progress possible in the control of these animals during the past year. The total number of coyotes killed and their scalps secured was 34,092, but animals actually found is not a measure of the number destroyed in poisoning campaigns. Skilled men are now employed during

six to nine months or more of the year working in cooperation with stockmen's associations and other local organizations in the systematic prosecution of the poisoning work. They spend practically their entire time in establishing poison stations, distributing baits, demonstrating methods to stockmen, and aiding them to establish and maintain effective poison lines. Relatively little time is now spent in searching for animals killed, as the value of the skins collected commonly would not pay for the time lost. This procedure is strongly urged by stockmen, who have become fully convinced as to the effectiveness of the poisoning operations, and whose first concern is to have the poison distributed carefully and on the largest possible scale.

Effective poisoning operations are conducted in summer, especially about watering places, but the work is done chiefly from October to April. Careful study is made of coyote conditions by experienced men stationed in each of the States, and, so far as practicable, the campaigns are launched chiefly after the livestock leave the summer or winter ranges, in close cooperation with the stockmen using the range. By systematically placing feeding stations and poisoned baits, and by posting notices and otherwise notifying the residents of the district, valuable dogs or other animals are protected. In settled country or other places where such action is desirable extended lines of feeding stations are often established and maintained until the coyotes become accustomed to feeding at them, and then small, specially prepared poisoned baits are placed, and a short, intensive campaign carried on, often resulting in the destruction of practically all the coyotes in the territory. Any poisoned material left uneaten is then picked up and destroyed or used elsewhere. Livestock losses over large areas have been practically ended by systematic work on summer and winter ranges and on lambing grounds. The total area covered in this work during the past year has been much greater than in any preceding year.

During the year more than 3,567,000 especially prepared poisoned baits were methodically put out in accordance with definite plans, and these poisoning operations covered an area of about 284,400 square miles.

One hunter and a cooperating stockman established a line of poison stations in Oregon, and the first time they returned over it found 29 dead coyotes. A ranchman in Texas reports finding 57 dead coyotes along part of a 100-mile poison line which he established in accordance with directions given him. A rancher in Arizona reports that his men found 140 coyotes which they had poisoned by following instructions and, although coyotes had been abundant formerly, little trouble was experienced after using the poison. Another cooperator and his herder maintained a poison line in Oregon during the winter and picked up 87 dead coyotes. This practically rid his range of coyotes before spring.

Over great areas of range the destruction of coyotes has been so thorough that stockmen have been able to reduce the number of men required to handle their flocks. Many stockmen now report carrying their flocks through the lambing period with absolutely no losses from coyotes in localities where previously they were heavy. In addition to the direct saving of lambs, growing stock, and breeding animals, stockmen by this service can handle their herds at less expense and utilize the pasture more fully. Freedom of the range from predatory animals eliminates the need for long drives to bedding grounds and permits the use of the open-herding system, which is beneficial both to the sheep and to the range. Similar savings accrue also to producers of other kinds of livestock and of poultry. The destructiveness of coyotes to sheep was emphasized in a poster issued during the year for cooperative work in South Dakota (No. Bi–701), the chief feature of which was the direct question, "Why feed coyotes?"

Poultry production is becoming an increasingly extensive business in large parts of the country now occupied by coyotes, and with the destruction of these pests it can be developed on a more profitable scale. Their destruction has greatly benefited cattlemen also, as it has become evident that coyotes are exceedingly destructive to calves on farms and ranges, often materially reducing the calf crop and thus cutting down at a vital point the possibility of profitable livestock production.

In California, where an outbreak of foot-and-mouth disease resulted in great losses of livestock, Biological Survey representatives cooperated effectively with the Bureau of Animal Industry by conducting poisoning operations to eliminate coyotes or other possible carriers of the disease, and

so planned and organized the work that experienced men could be placed promptly in any locality where the disease might make its appearance or where this work would afford added protection against its spread.

In addition to beneficial results of this work accruing to the livestock industry, for which it is primarily conducted, the benefits to game resulting from coyote eradication have been very marked. In areas where coyotes have been destroyed, deer and antelope are reported to have raised a much larger proportion of the fawns than was known in recent years, and a marked increase of quail, grouse, and other ground-nesting game birds has been reported from many points in the West where the poisoning campaigns have been conducted.

Mountain lions still occur in numbers throughout much of the mountainous country in the West and are chiefly destructive to colts, calves, and sheep among domestic animals and to deer, elk, mountain sheep, and mountain goats among the larger game animals. During the year 237 mountain lions were killed by employees and cooperators of the Biological Survey in the Rocky Mountains and Pacific Coast States, making a total of 1,236 mountain lions killed since this work was organized in 1915.

Individually these animals range over great areas, apparently making more or less regular rounds in pursuit of their prey, and are hunted eagerly by sportsmen. The animals killed in this way, coupled with the work done in the organized campaigns, has led to a marked reduction in their numbers. At present the distribution of mountain lions is somewhat local, only a few usually occurring in a given locality. They are ordinarily hunted with dogs and rifle, but at times are successfully trapped and poisoned.

One herder in Arizona, after having 80 sheep killed one night by a mountain lion, put out poison according to instructions and the following day found the offender dead. Two private hunters in Arizona were instructed in methods of poisoning mountain lions and later reported killing 14 of them during the winter. One of the regular hunters in Arizona killed 15 during February following a heavy snowstorm which had driven the animals down out of their usual range into an area that had previously been practically cleared of them.

In the State of Washington 11 adult mountain lions were killed, among which were 3 that had nearly exterminated the mountain goats in Mount Rainier National Park. During March a lion hunter in Colorado succeeded in killing a large male in the Pike National Forest just inside the Denver Mountain Parks Game Refuge. He had previously trailed this lion during December, but it made its escape after killing his leading dog. While trailing it in the Tarryall Mountains the hunter found that it had made serious inroads on the mountain sheep of this section, and while tracking it in the Denver Parks Game Refuge he found two deer which it had killed but a short time before. Another mountain lion, killed in Colorado in April, had recently killed a fine five-point buck.

One of the experienced hunters in Montana made a snowshoe trip of 400 miles and only secured 1 adult lion where two years before he took 23. In another section of western Montana where one of the bureau hunters caught several mountain lions two years ago, two men who knew the country well were only able to take two of them during the past winter, and the evidence indicated that but few are left in this section, although formerly it was heavily infested. Larger herds of deer have been reported in these localities recently than for years, a fact which sportsmen attribute mainly to the destruction of the mountain lions. Relatively few of these animals now occur in sections where livestock is being produced, and their control can be effected readily through the assignment of skilled hunters as conditions require.

Oil of catnip, the first use of which as a bait was mentioned in the report of last year, continued to be used effectively by hunters trapping mountain lions and bobcats, and arrangements have been made to obtain an additional supply from this year's crop.

Bobcats and lynxes.—During the year 3,448 bobcats and 59 Canada lynxes were taken by our official hunters. Bobcats occur in considerable numbers throughout the mountainous sections of the West, while lynxes are confined to the more northern regions and the higher mountains. Both feed to a large extent upon rabbits and other rodents, but are often exceedingly destructive to sheep, goats, antelopes, pigs, calves, and poultry. In certain parts of Arkansas, where bobcats are common, their destructiveness makes hog raising impracticable. Many deer, especially the fawns, and wild turkeys, quail, and other ground-nesting birds

are destroyed by them. They are taken readily by the use of trained dogs and are easily trapped. The use of oil of catnip has proved to be a particularly effective bait. Some hunters report that they have succeeded in taking every bobcat that came into the vicinity of traps baited with catnip oil. Bobcats are far less successful than coyotes in maintaining themselves in the face of civilization and rarely, if ever, regain territory from which they have once been eradicated. They are eagerly hunted by private hunters for sport and for the value of their furs.

Bears.—The hunters of the Biological Survey are instructed to consider bears as game animals and not to kill them except in cases where they are known to be destructive to livestock or where, in cooperation with State game departments, they are to be killed because of their destructiveness to game. They are protected by the game laws of practically all the Western States. Large numbers are killed by sportsmen during the open season, and this ordinarily serves to keep them well under control. In some localities the animals are reported as becoming overabundant and at times are excessively destructive to livestock, especially when there is a shortage of their natural food. Individuals, particularly grizzly bears, also become addicted to such killing and then it is necessary to destroy them as predatory animals. In the 17 States in which predatory animal work was conducted 193 bears were killed by official hunters during the year.

One notable kill was made in the Okanogan Forest Reserve in Washington. This bear, a grizzly, had been responsible for heavy losses during the past three years, and was definitely known to have killed 35 head of cattle and 150 head of sheep during the summer of 1923. The latter part of July it appeared near a camp after dusk and attacked a 4-year-old steer. Hearing the noise, the camp foreman investigated and found the grizzly holding the steer with its forefeet and biting at its neck. A shot failed to take effect and the bear ran away. At the request of livestock owners, an experienced hunter with trained dogs was assigned to the task and effected the capture of this notorious animal in about three weeks. This bear weighed over 1,100 pounds.

The utmost care is exercised to avoid killing bears through mistaken identity as to the culprit responsible for livestock losses. The following case illustrates the careful discrimination exercised by our hunters: A report that a bear was killing sheep in Nevada near Lake Tahoe was personally investigated by the inspector. It was found that 15 sheep had been killed and tracks showed where a bear had been eating from the carcasses. Close inspection, however, showed where a large coyote had dug his claws into the ground in making a turn to catch one of the sheep. Further investigation showed places where a coyote had been sitting and had made short runs to the various places where the kills had been made. Acting on this evidence as to the animal responsible for the killing, poisoned baits were distributed along a trail traveled by the coyote, and the herder reports no further losses "from bears" during the season.

RABIES

In Washington, Oregon, northern California, Nevada, Utah, and Idaho rabies was of widespread local occurrence for several years among coyotes and bobcats and has resulted in heavy losses of livestock and the biting of many people. The measures employed have brought it so fully under control that only occasional outbreaks were reported during the year. Whenever an outbreak was reported experienced hunters were concentrated and promptly destroyed the wild animal carriers of the disease and the spread of the disease was quickly checked. In Washington two serious outbreaks occurred, but prompt and effective cooperation between Federal and State officials ultimately controlled the situation.

Similarly effective cooperation in cases where rabies made its appearance among domestic animals in Arizona and New Mexico, and the prompt destruction of coyotes and other possible wild carriers in zones surrounding the points where the disease appeared, made it possible to prevent its spread.

A most serious situation developed in Colorado, where apparently the disease was introduced on the San Isabelle Forest by a rabid dog. The case was not reported for several months, and a large number of cattle and other domestic animals were bitten and died. Five people also were bitten and promptly took the Pasteur treatment. One of these was bitten by a bobcat, two by coyotes, and two by dogs. Responding to the emergency thus created, the bureau made a spe-

cial detail of men to conduct a vigorous poisoning campaign against possible wild carriers in this district with the cooperation of stockmen and local officials. Large numbers of coyotes were killed in the poisoning campaign, as many as 16 being found at a single poisoning station. As a result, the range was thoroughly freed from coyotes and bobcats and the disease effectively controlled.

Rabies later appeared among dogs and coyotes on the eastern edge of the San Luis Valley in Colorado and spread rapidly. When the disease was reported to the Denver office prompt action was taken. The evidence indicated that it had been brought in by rabid coyotes or dogs which had crossed the Sangre de Christo divide in the vicinity of Pass Creek. A meeting of representative citizens was held and the San Luis Valley Anti-Rabies Association was formed and presented the situation to the county commissioners of six counties. County funds were promptly appropriated to cooperate with the bureau and the State board of stock inspection commissioners for carrying on a thorough eradication campaign against worthless dogs and coyotes and other predatory animals that might serve as carriers. Regulations regarding the muzzling of dogs and cats also were enforced. Ten hunters were placed in the territory under the immediate supervision of a field assistant, and at the close of the year the situation was well in hand. Occasional outbreaks may be expected, however, and effort must be continued to prevent further spread of the disease. Without such prompt control measures rabies might spread over the entire West, with appalling results.

RODENT PESTS

Steady progress has been made in the control of those rodents which have persisted and, in many instances, increased excessively in the face of ordinary agricultural and stock-raising conditions. Because of their numbers and widespread distribution they cause heavy losses of farm crops and forage grasses, also in orchards, vineyards, truck farms, and nurseries.

Investigations by the Biological Survey have determined successful methods of reducing the number of rodent pests, and plans have been devised for large-scale organization of systematic field operations to this end. Federal, State, and local agencies are so correlated that the work of clearing great areas can be conducted in an orderly way. The work has been supported consistently by farmers and stockmen, as the direct benefits evident from it appeal to their business judgment. Large-scale operations have been greatly facilitated through the hearty cooperation of the Office of Cooperative Extension Work and the State extension service organizations, including the county agricultural agents and State and county farm bureaus. A poster (No. Bi–761), issued for use in the cooperative work with the Wyoming Extension Service, was helpful in drawing attention to the enormous losses caused by rodent pests in the State and to the comparatively simple method of deriving profits through increased stock production on areas where losses are suffered from range-destroying rodents. State departments of agriculture, county commissioners, and many agricultural, horticultural, and livestock organizations have taken an increasingly active part in the undertaking, and officials of the Forest Service, the Office of Indian Affairs, and the Reclamation Service cooperated most helpfully on their lands. The bureau continued to cooperate with the United States Public Health Service of the Treasury Department, and with State, county, and municipal health organizations in lines of work where rodents are important agencies in the dissemination of such diseases as bubonic and pneumonic plague, Rocky Mountain spotted fever, and tularaemia.

Prairie dogs and ground squirrels.—From the earliest settlement of the mid-West and the Western States the ground-squirrel and prairie-dog problems have confronted the farmer and stockman. Production of farm crops made conditions all the more favorable for constant increase in the numbers of these pests through the provision of a nutritious and readily available food supply. Especially in dry weather, when their natural food is scarce, these animals congregate on the cultivated areas, dig up the planted seeds, and sometimes the roots of the plants, and feed upon growing or harvested crops. They make serious inroads into grain fields and often completely devastate large areas. So long as there was an abundance of free pasturage little heed was given to the destructiveness of these animals to forage grasses. With the more complete occupation of the land by flocks and herds, and a growing necessity for giving greater attention to management details in order to ob-

tain a profit, there has developed a more persistent demand for eliminating the competition from these pests.

Prairie dogs often completely denude productive grazing lands of all the valuable forage grasses. It is common for prairie dogs and ground squirrels to reduce the forage available for livestock from 25 to 50 per cent. By selecting the more fertile lands their competition with livestock is rendered especially serious, because they feed upon the same nutritious grasses that are most sought by livestock. Occurrence of such animals in large numbers results in a marked decrease in the numbers of livestock that can be maintained on a given area. Their presence also interferes with the success of deferred grazing or grazing rotation practices, as they continue to feed upon the grasses during the period that stock are kept off and, finding such areas more favorable for their feeding, increase in numbers and destructiveness.

Campaigns organized to combat prairie dogs and ground squirrels during the past year covered 8,000,000 acres of Federal and private lands, which were given a first treatment with poisoned baits, and follow-up work with poison or fumigants on previously treated areas was done on 6,000,000 acres. This makes approximately 12,000,000 acres of Federal and 105,000,000 acres of State and private lands on which a large percentage of these pests have been poisoned since 1916 in Arizona, California, Colorado, Idaho, Kansas, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, South Dakota, Utah, Washington, and Wyoming. The Biological Survey and cooperating Federal agencies assume the cost of operations on the Federal lands. Owners of adjacent lands, however, continue to contribute much of the labor required to distribute the poison, and furnish much of the grain used as bait, in order to cover the largest possible acreage with the limited Federal funds and thus reduce the numbers of the animals migrating from the Federal to the adjacent private lands. State officials and county commissioners have provided for work on State lands, and farmers and stockmen have borne the cost on their own holdings.

Except in California, where the occurrence of the foot-and-mouth disease prevented the usual progress of field operations during the spring, there has been a steady advance in the work accomplished. A total of 833 tons of poisoned grain was prepared and distributed under the supervision of bureau representatives and cooperating State and county officials, and 100,000 pounds of carbon bisulphide and 175,000 pounds of calcium cyanide were used in fumigating burrows to complete the eradication of rodents. Farmers and stockmen who took an active part in clearing their own lands, and in many instances aided on Federal lands, numbered 66,000.

It is estimated that a saving of more than $4,000,000 was accomplished during the year, bringing the total estimated saving of crops and forage since this work was started on a large scale in 1916 up to $72,000,000.

Many counties have adopted the plans proposed by the Biological Survey for coping with prairie dogs, and 11 counties in three States are reported as being free from them. Many others are from 95 to 98 per cent cleared, and other large units have adopted the plan of an intensive three-year campaign for the extermination of these rodents. From 75 to 95 per cent of the prairie dogs or ground squirrels are usually destroyed by the first poisoning treatment. Getting all the remaining survivors at times proves a difficult undertaking, but the work is being pushed with determination, and poisoning is being followed up with the use of carbon bisulphide and other fumigants. Marked improvement is reported in forage production on grazing areas which have been cleared.

The bureau has continued to arrange for the purchase of poison supplies in large quantities for use in the campaigns, and this has greatly reduced the cost to cooperators. Efforts have been continued to correlate work in each State with that in adjacent States in order to prevent reinfestation by migration. Where it has been impracticable with funds available completely to eradicate these rodents from Federal lands, effort has been made to correlate the work with that of adjacent landowners so as to afford them the most complete protection possible and at the same time to increase the productivity of the Federal lands. With the clearing of increasingly large areas of private lands there is a constantly growing demand upon the bureau to clear the pests from Federal lands so as to eliminate them from their breeding grounds. Stockmen who are leasing parts of Federal lands also urge the importance of eradicating the rodents as one

of the most direct and practical means of range improvement.

Pocket gophers.—The damage which pocket gophers do in orchards, vineyards, and alfalfa fields, and to truck crops, and demonstration that their control is practicable, have increased the efforts made to destroy them in Arizona, California, Colorado, Idaho, Kansas, North Dakota, Oklahoma, Oregon, South Dakota, Texas, Utah, Washington, and Wyoming. Skepticism as to the possibility of eradicating these ground-burrowing rodents at a reasonable cost is being eliminated with success attending trapping and poisoning demonstrations.

One rancher in Colorado used traps and caught 240 pocket gophers in his native-grass meadow and now has it practically free of them. He keeps traps constantly about the field for use whenever one of the animals invades his land. A farmer in North Dakota completely eradicated pocket gophers from 160 acres of alfalfa by poisoning. Citrus growers and farmers in five counties in Arizona waged an effective campaign against these animals, and the three railroad systems within this territory cooperated by poisoning them on their rights of way. In Idaho four counties used 1,280 quarts of bait on 46,000 acres, getting about 80 per cent of the animals with the first treatment, and 35,000 acres that were given a second treatment showed about 95 per cent kill. In Washington much work was done in orchard sections.

A number of demonstration farms have been used where areas are cleared of the pocket gophers and where farmers of the vicinity learn the methods employed and see the benefits resulting from eradication of these pests. Such demonstrations are leading many farmers to undertake to clear their land. In South Dakota many alfalfa fields had to be plowed up and planted to corn on account of the damage done by pocket gophers. As the acreage of alfalfa is being enlarged in this State, there is a marked increase in the demand for destroying these animals. In certain parts of Kansas pocket gophers showed such marked increase during the year that efforts for their control have been undertaken with renewed energy. Two counties have undertaken the work as major projects and this work is in progress in practically all of the eastern and central counties of the State. Trapping and poisoning the animals and leveling the mounds have resulted in marked benefit to the alfalfa crops and have eliminated much annoyance and loss due to damage to machinery during harvest. Trapping and poisoning have been continued along the banks of irrigation ditches to prevent the breaking of the banks through pocket-gopher burrows. One of the most extensive tasks of this kind has been accomplished at the Elephant Butte irrigation system in southern New Mexico.

An appeal was recently received from the commanding officer of the United States naval air station at San Diego, Calif., for assistance in ridding the landing fields of both the Navy and Army air stations from the pocket gophers which infested them. Not only were the animals undermining the fields and causing serious accidents to the landing planes and endangering the flyers but they were also destroying lawns and gardens. About 1,500 acres were involved on this island. An assistant was detailed to take charge of the eradication operations, the bureau furnishing the necessary poisons and traps, while the air-station officials furnished labor and other materials. After application of the poison, a steam roller was used to level all the mounds and thereby make it easier to locate any new ones that might appear. As a result, the station was practically cleared of pocket gophers, and the work is being followed up with a view to coping promptly with any further animals that may put in an appearance.

Jack rabbits and cottontails.—There was great variability in the abundance and destructiveness of jack rabbits during the year. Efforts for their control were conducted in Arizona, Idaho, Kansas, North Dakota, Oregon, South Dakota, Texas, Utah, Washington, and Wyoming.

In localities where the animals were doing serious damage, effective control work was accomplished through poisoning operations and the organization of drives. Cooperative drives in Colorado netted 20,000 rabbits, which were shipped free by cooperating railroads for distribution in Denver to charitable organizations. Two drives covering two and one-half townships in Kansas netted 10,000 rabbits. Jack rabbits are reported generally on the increase in that State. They are also reported on the increase in many parts of North Dakota, where two drives resulted in the killing of 13,000. Drought in Oregon during the spring of 1924 caused rabbits to congregate from wild lands into cultivated areas, where they caused considerable de-

struction of growing crops. Approximately 50,000 of these animals were killed by poisoning operations in Morrow County alone. In Texas 12 drives yielded about 25,000 jack rabbits. In Utah 340,500 were reported killed on 128,220 acres by poisoning operations, in which 536 ranchers participated.

The following note received from the Forest Service in reference to snowshoe rabbits in Minnesota is of interest:

> The snowshoe rabbit is the one principal factor in the loss of a considerable number of planted trees in the forest plantations of northern Minnesota. The abundance of rabbits this year and the damage they are doing are evident to the most casual observer who visits the cut-over areas of the region where both State and Federal authorities are endeavoring to make denuded forest land again productive through extensive planting of young pine seedlings. Not only are the tips and needles of planted trees eaten by the rodents, but much of the natural young growth of pine, spruce, aspen, and maple is cut back and defoliated or barked near the base if the trees are over 3 feet high. Of the three principal species planted—white pine, Norway pine, and white spruce—the damage is heaviest in the white pine and least in the spruce. All three, however, are so heavily damaged as to cause death in the case of any of the trees whose tips can be reached above the surface of the snow by the rabbits. It is reported that 79 per cent of the trees in one plantation were eaten off by the rabbits, 43 per cent fatally. In another instance practically the whole plantation of white pine was destroyed by the rabbits.

Reports of damage in orchards by cottontails were received from many sections throughout the country. The use of protective devices recommended by the bureau afforded a large measure of relief. These animals are usually regarded as game and are ordinarily kept in reasonable numbers by hunters, but they have increased considerably in a number of regions. At the close of the year a publication was in press on the distribution of the European hare in North America (Journal of Agricultural Research).

Woodchucks.—Heretofore complaints of damage by woodchucks have come more largely from the Northwestern States, where these animals live in rim-rock formation, from which they invade neighboring vegetable gardens, truck farms, and alfalfa fields and do extensive damage. More recently the seriousness of the damage done by woodchucks in the Northeastern and mid-Western States has become evident, and they appear to be increasing rapidly in many sections. They do extensive damage by making burrows in hillsides, which are often the beginning of serious erosion. Their excavations in the banks of levees often permit water to run through in times of high water, breaking the levee, flooding large areas of adjacent farm land, and destroying crops. They also do extensive damage by feeding upon clover and other valuable forage plants and upon root and vegetable crops in truck farms and gardens.

Investigations were conducted and improved methods developed for fumigating burrows of woodchucks in the Eastern States. Carbon bisulphide and calcium cyanide were found effective for destroying them in their burrows. Campaigns of considerable extent were conducted in Morgan County, Ind., and Stark County, Ill., in which representatives of the bureau demonstrated methods and assisted in the organization of the campaigns. Farmers joined enthusiastically in this work, and very satisfactory results were obtained. In Idaho demonstrations were given and 13,500 acres of infested lands were treated with 2,700 pounds of poisoned bait. A number of demonstrations were given in other States where damage was reported, and much information on the control of these animals has been furnished through correspondence.

Field mice.—Educational work in bringing the seriousness of damage by meadow mice and pine mice to the attention of orchardists, truck farmers, and gardeners has led to a marked increase in the applications for control measures. Extended demonstrations have been given in many States showing orchardists how to distribute poison in such a way as to eradicate these pests before the season when damage is most likely to occur. These animals are so small and often increase to such inordinate numbers in a very short time that they cause serious damage before anyone is aware of the danger. Efforts have been made to induce orchardists to make mouse control a regular feature of their orchard management practices, since losses from this source some years run into millions of dollars. To assist in this work, Farmers' Bulletin No. 1397, "Mouse Control in Field and Orchard," was issued in March.

In the Yakima Valley, Wash., where orchardists, following demonstrations and the organization of a campaign, were successful in destroying mice, and thus protecting their orchards in the face of a serious outbreak of these animals in 1922 and 1923, poisoning operations were again carried on actively as a means of insuring against a recurrence of losses. Work against mice in five of the more im-

portant orcharding counties covered 34,270 acres, and 853 orchardists cooperated, using 53,180 pounds of poisoned grain.

In Idaho 1,200 acres of orchard were treated with 1,296 pounds of poisoned grain. Local outbreaks of mice in Oregon were promptly controlled by poison. Field-mouse control demonstrations were arranged and conducted during the fall months in the important orcharding sections of Massachusetts, New Jersey, West Virginia, and Indiana.

Cotton rats.—In Arizona active work was done by the citrus growers against cotton rats, which had suddenly appeared in destructive numbers. One grower killed 408 of these rodents in a 6-acre grapefruit orchard. Another, by the use of a few cents' worth of poison killed two cotton rats, which, within a few nights in one nursery, had killed 1,000 young citrus trees worth more than $1 each.

Kangaroo rats.—Extended investigations on the Jornada Range Reserve in New Mexico showed that kangaroo rats were causing a loss of forage amounting to an average of 5 per cent of the possible production. On 78,000 acres that were treated for the destruction of these animals the dens averaged more than 3 per acre, and in some parts of the area infestation ran as high as 18 dens per acre. About these dens the kangaroo rats had completely destroyed the grass in considerable areas. The dens of these animals are a source of annoyance and loss also, as cow ponies are frequently thrown when being ridden after stock. The cost of eradication by poisoning was less than 2 cents an acre. Stockmen of the vicinity watched the work with great interest and many have already expressed their desire to rid their ranches of these animals. They are willing to furnish all labor and grain if the Biological Survey can arrange to furnish sufficient supervisory direction to insure success.

House rats and mice.—House rats are of more universal concern to the people of the United States, from the Atlantic to the Pacific, than any other wild animal pest. They have long been recognized by experienced observers as the most destructive species of animal in the world and as one of the most dangerous from the standpoint of the transmission of communicable diseases. An abundance of food and plenty of shelter in cities, towns, and rural districts has enabled them to intrench themselves almost everywhere that man has established his abode. Even the more arid sections of the country are being slowly invaded. In dry-farming areas they establish themselves about the home, barns, and poultry houses, where they carry on their usual nefarious activities.

The bureau has continued to furnish information regarding the destructiveness of house rats and mice and the danger to health from their presence. Practical methods for their control have been presented through publications, demonstrations, and the organization of control campaigns. Especially good progress has been made during the year in working out and applying detailed plans for the organization of community campaigns. Generally the county, including urban and rural districts, is the most practical unit for handling antirat campaigns, as it is of sufficient size to permit the careful working out of all details essential to success. These campaigns have received the most gratifying support from the public press, county and municipal officials, business men, civic, social, and welfare clubs, and public-spirited citizens generally. In connection with their freight, express, warehouse, and dining-car service, railroad officials have cooperated actively with communities where rat-control work was undertaken. Increased interest is also being shown by hotels, restaurants, packing houses, markets, and other concerns engaged in preparing, storing, or providing food products for the use of the public.

With a view to the prompt control and ultimate elimination of the rat pest, emphasis has been placed on the importance of rat-proof construction or repair of buildings, closing basement windows, and all other openings which provide entrance for rats, promptly disposing of garbage and eliminating piles of trash and refuse where rats find food or shelter, poisoning rats wherever possible and systematically trapping them elsewhere, fumigating rat burrows with such poisonous gases as carbon bisulphide, calcium cyanide, or hydrocyanic-acid gas, using effective rat dogs, and organizing community killing drives.

Demonstrations in rat control have been given during the year in Arkansas, California, Colorado, Idaho, Illinois, Indiana, Kansas, Massachusetts, New Jersey, New Mexico, North Dakota, Oklahoma, Oregon, South Carolina, South Dakota, Texas, Utah Washington, Wisconsin, and Wyoming

General assistance has also been given through correspondence and supplying copies of Farmers' Bulletin No. 1302, "How to Get Rid of Rats," for which there has been a remarkable demand. The preparation and issuance of the moving picture entitled "The Modern Pied Piper" has met an important need for publicity material of this character, graphically presenting, as it does, the essential features involved in organizing and conducting effective warfare against rats. The demand for this film has been greater than it has been possible to meet. A poster (No. Bi–733) issued during the year, depicting rats as "vandals of the night," has also been of help in stimulating intolerance of this pest.

As illustrating the general character of the campaigns conducted, the following instances may be cited: At Little Rock, Ark., where rats had become an intolerable nuisance as a source of loss and a menace to health, a live committee of a local women's club appealed to the bureau for assistance in launching and carrying out a drive against the pests. Two specialists were assigned to aid in this work. Material calling attention to the importance of the campaign and plans for its conduct were disseminated by means of newspaper articles, circular letters, billboards, window cards, and illustrative slides at picture shows. When everything was in readiness, the drive itself was launched and in it 3,000 pounds of poisoned bait were distributed, sufficient to make 48,000 individual rat baits. These were distributed throughout the entire business district comprising approximately 100 city blocks, along the water front, on city dumps, and in other places where inspection had disclosed rat infestation. In this instance $400 worth of prizes were offered for various points. As evidence of the effectiveness of the drive, 12,400 rat tails were turned in.

As only a very small proportion of the rats killed by poisoning with barium carbonate usually die outside their holes, where they may be found, this number will give some idea of the number actually destroyed by this campaign. In this instance, as is usually the case where antirat campaigns are organized under the leadership of the bureau, the special rat drive led to results of more permanent character looking to improved economic and sanitary conditions. Ordinances were enacted, one providing for the rat-proofing of buildings and another requiring property owners to clear away débris and clean up property following fires. Provision was made to stop the leasing of city property along the river front, with a view to making this into a city park instead of a rat harbor. The approximate cost of this campaign to the people of Little Rock was $6,850, which covered prizes, poison, bait material, advertising, and considerable labor.

Important rat control operations also have been in progress in Portland, Oreg., in cooperation with the city health office. Without inaugurating a special drive, the work has been carried forward steadily along progressive lines. Information has been furnished business houses and the citizens generally regarding its importance and the practical means of accomplishing the desired results. Demonstrations have been given showing poisoning and trapping procedure and essential features in rat-proof construction or repair of buildings. Special attention has been given to the city markets, with most gratifying results in enlisting the cooperation and support of the business concerns. Buildings, docks, and warehouses to the number of 371 were inspected and methods suggested for making them more satisfactory from the standpoint of rat-proof construction; and 103 other buildings inspected were found to be in good condition. Supplies of poison, sufficient to meet requirements, were prepared and distributed; 927 pounds of poisoned bait have been placed on the city fills and dumps, which were previously badly infested with rats, and 425 pounds of calcium cyanide have been used on the city dumps and along the river banks. The work has progressed to a point where it is only a question of time and effort largely to eliminate losses from rats in this community.

Another important case is that of the Center Market in the city of Washington, D. C. When the Department of Agriculture took over the management of this great city market the place was found to be badly infested by rats. There was not only loss in food products but also danger to health through contamination of food, especially that to be eaten raw. So serious was the infestation that some who had noticed the conditions hesitated to purchase their food supplies there. Control measures were inaugurated quietly in order to clear up the situation and not unduly disturb the public. Barium carbonate was distributed under carefully controlled conditions, and 300 rats were found killed at one

time. Traps also were used on a large scale. Accumulated rubbish was cleared away, infested hollow walls and other structures were replaced by rat-proof construction, more sanitary and rat-proof booths were built of concrete, and a large incinerator was installed to consume garbage and other rubbish. Special attention was given to rat-proof food-storage places, including all cold storage. The interest of the dealers was enlisted in the effort, and many neighboring commission houses, at their request, were assisted and have adopted measures recommended for the protection of the food products which they handle. While the market is still subject to some invasion by rats from surrounding property and through introduction with shipments of food, necessitating follow-up work, conditions have been vastly improved, and from this standpoint the market is now one of the most satisfactory in the country. This has proved a valuable object lesson to other markets which have undertaken similar improvement.

In many parts of the country there has been much interest in the control of rats about poultry houses, because of their destructiveness to eggs and young chicks and of their serving as possible carriers of avian tuberculosis. The Biological Survey has given special attention to meeting the requirements of poultry producers by working out methods suited to their particular needs.

Investigations have been continued to improve methods of combating rats. In this the bureau has had the helpful cooperation of the Bureaus of Animal Industry, Chemistry, and Plant Industry, and the Hygienic Laboratory of the U. S. Public Health Service.

MOLES

The bureau has continued to demonstrate and furnish, through publications, practical methods for the control of moles where they are doing damage in lawns, gardens, truck farms, pastures, and hay meadows. Investigations also have been continued with a view to determining more simple and easily applied methods for the control of these animals.

EXHIBITS AT FAIRS

The economic work of the bureau has been represented in exhibits of the department at State and interstate fairs in Arizona, California, Colorado, Idaho, Kansas, Montana, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Texas, Utah, Washington, and Wyoming. The damage by rodent infestation to forage production on the ranges and methods of economically and effectively destroying these pests were thus graphically depicted, together with damage by predatory animals, with methods of control.

Mounted specimens of both rodents and predatory animals were made a part of the exhibit, a very interesting feature of which showed a bobcat destroying a lamb. Field men of the bureau cooperated in the exhibits by adding live specimens and other material to bring out local conditions. The attendance at these booths has been quite marked, and from the information given increased cooperation has resulted on the part of ranchers visiting the fairs.

FUR RESOURCES

Investigations of fur farming and the study of fur resources have so increased in importance during recent years as to make their establishment as a separate division of the Biological Survey generally advantageous. Arrangements to this end were completed during the year and, effective July 1, 1924, a new Division of Fur Resources will be created in the bureau, by separation of this line of work from the Division of Economic Investigations.

Investigations in connection with the production and conservation of fur-bearing animals have been carried on during the past year, and the progress made has been gratifying. The bureau has kept in close touch with fur farmers, raw fur buyers, dressers, dyers, manufacturers, and retailers. In compliance with requests it has aided in the formation of State fox breeders' associations, as well as encouraged the amalgamation of the American and the National Silver Fox Breeders' Associations. Encouragement also has been given to the movement for the registration of silver foxes and the formation of one national registration association, and satisfactory progress has been made along these lines. Support has been given to proposed legislation for the conservation of fur-bearing animals with a view to maintaining a permanent supply.

In response to requests assistance has been given to a number of States in revising existing laws and in drafting new ones for the protection and

propagation of fur animals. The active help of State game commissions, conservation societies, and the fur trade has been enlisted in conserving fur bearers in the wild, since the maintenance of a supply adequate to meet the requirements of the fur trade is of the utmost importance. An advanced step was taken at the President's Conference on Outdoor Recreation, held in Washington, D. C., in June, when those assembled went on record as favoring the formation of a permanent organization for the purpose of devoting considerable effort to the study of the problems of wild life conservation.

Fur farming.—Fur farming as a commendable adjunct to conservation in keeping up the supply of raw furs is being given encouragement by the bureau. It is estimated that approximately 1,200 fur farmers in the United States and Alaska are engaged in the production of one or more species of fur-bearing animals, the majority of them raising silver and blue foxes. The total investment in the business is somewhere between $12,000,000 and $15,000,000. By scientific investigations constant effort is being made to obtain information essential to the requirements of the growing industry. Fox ranches in the United States have been inspected for the purpose of studying methods used in breeding, feeding, and handling fur animals. A number of fox farms were visited in order to study outbreaks of contagious diseases and parasitic infestation in order that the bureau might be in better position to advise ranchers in their efforts to combat similar outbreaks.

The bureau has continued to promote sound education in fur farming and the conservation of fur bearers. With this object in view it has released through the press service of the department and published in various fur-trade journals numerous articles dealing with these subjects. A department bulletin on blue-fox production in Alaska has been nearly completed and, it is hoped, will be available for distribution shortly.

Experimental fur farm.—The most important work accomplished during the period covered by this report was the selection of a suitable location for the experimental fur farm and its removal from Keeseville to Saratoga County, N. Y. The new farm is equipped with modern buildings, pens, and dens, a small laboratory in which to study diseases and parasites, and a utility house divided into a storage room, carpenter shop, and feed room.

Experiments are being conducted at the fur farm with red, cross, and silver foxes, skunks, and martens. Records are kept of the quantities and kinds of feed required for fur bearers, to determine the effect certain feeds or combinations of feeds have on the animals and the furs produced, and the quantities which give best results under varying conditions. Studies and observations also are being made of the animals during the breeding, gestation, and whelping periods, to work out problems in genetics and handling practices.

Diseases and life histories of internal and external parasites have been studied for the purpose of determining methods of prevention and treatment. Important progress has been made in these studies and in determination of age and seasonal susceptibility of animals to infestation and their tendency to develop immunity toward such infestation, and experiments have been made with remedial agents for the removal of parasites. Improved methods of handling the animals during treatment have been devised and valuable data gathered regarding the tolerance of foxes to various drugs. The resulting information, which is essential to proper treatment at various ages and under different conditions of health and vigor, will shortly be published in the Journal of Agricultural Research under the title "Anthelmintic Efficiency of Carbon Tetrachlorid in the Treatment of Foxes." As a basis for clinical and diagnostic work, studies have been continued on various features of the physiology of fur bearers, including the pulse, respiration, and temperature.

The information obtained by experimental studies on the fur farm, together with observations made in the field, has been assembled in the form of letters and published articles and distributed free of charge to those requesting it. Prospective breeders, as well as those now engaged in fur farming, have derived benefit from the findings, and State agricultural colleges and experiment stations, State game commissions, and conservation societies have been rendered assistance in solving their problems.

The benefits derived from the work at the experimental fur farm do not end with the actual raising of animals in pens. The data obtained form a background of necessary information in connection with the formulation of trapping laws and in helping to establish the fur industry on a sound basis.

FOOD HABITS RESEARCH

MORTALITY AMONG WILD BIRDS

One of the most interesting occurrences of the year in connection with our work on migratory wild fowl was the apparently mysterious death of a large number of canvasback ducks in Chesapeake Bay, Md. During December and January dead birds were found at various points in the upper part of the bay, but particularly in the neighborhood of Spesutie Island. At the request of sportsmen and others who were perturbed by the occurrence the Biological Survey made an investigation and found that the ducks had died from phosphorus poisoning. The alimentary canals of all the dead birds were well filled with food, chiefly winter buds of wild celery, but this material was reeking with phosphorus, so much so that it smoked upon exposure to the air and produced a noticeable glow in darkness. Particles of phosphorus the size of small chicken feed were numerous in the food contents and upon drying in the air would readily ignite. It is difficult to understand how birds could continue to swallow so corrosive a substance as phosphorus until their whole alimentary canal was saturated with it, but swallow it they did, and death was of course inevitable.

The phosphorus was obtained while the birds were feeding in a wild celery bed, where grenades charged with the chemical had dropped during experimental firing from the Aberdeen Proving Ground. Remedial measures recommended by the Biological Survey were promptly adopted by officials of the War Department. At first a boat was moored over the bed to frighten the ducks away, but this being carried off by ice renewed mortality occurred. Another boat containing a human effigy was then installed, as well as an automatic firing device, with the result that no more birds visited the bed. Because of the size of the area involved and the thoroughness with which the phosphorus is distributed over it, radical measures to remove the menace entirely are impracticable. The phosphorized wild celery bed will probably remain dangerous to canvasbacks while natural processes, such as silting over of the bed and gradual dissipation of the phosphorus, are in progress. Meanwhile efforts to keep the birds away from this death trap will be continued.

Mortality among wild ducks in Louisiana occurred as usual toward the end of the hunting season. An investigation revealed the number of birds affected to be not so large as reported, and the cause to be lead poisoning. This is a malady of ducks that may occur at favorite shooting grounds anywhere in the country, and the Biological Survey has previously published a bulletin (Department Bulletin 792) giving the history, causes, and symptoms of the trouble.

At the close of the fiscal year an investigation of alleged destruction of birds by poisoning operations in cotton fields was in progress.

ECONOMIC STATUS OF LAUGHING GULLS

On islands along the eastern shore of Virginia are considerable colonies of laughing gulls. This species is a medium-sized gull, by no means so omnivorous in its feeding habits as the larger herring gull which occurs in that section in winter. Nevertheless, emphatic charges were made that the gulls were destroying clams, scallops, oysters, and crabs to such an extent as to constitute a menace to the fishing industries of the region. A thorough investigation of the matter showed that whatever basis there may be for the charges lies in the depredations of the winter or herring gulls, and that even these are scarcely serious. The summer, black-headed, or laughing gulls were found to eat no large shellfish, very few crabs other than the worthless fiddlers, and no fish of commercial value. These gulls also appeared to be guiltless of egg eating, a pernicious habit so characteristic of some of the larger gulls. Nests of terns, clapper rails, and of other birds observed in close proximity to those of the laughing gull were in no way molested. In fact, these gulls really protect the eggs of their smaller neighbors by driving away marauding fish crows. Nothing disclosed in this investigation of the laughing gull in Virginia warrants any change in the protected status of the bird.

CONTROL OF DESTRUCTIVE BIRDS

In the annual report for last year mention was made of delay in issuance of a bulletin on magpies in order to permit inclusion of the results of further experiments in control of the birds. These were carried out the past winter in Colorado. A mild winter, with conditions rendering baits less attractive to the birds, hindered

the work somewhat, but fairly satisfactory results were obtained. Under the weather conditions encountered animal baits were found to be much more effective than vegetable. A method of exposing the baits to the birds, yet keeping them out of reach of dogs and other farm animals, was devised and gave good results.

Assistance was given to persons desiring to reduce the number of crows frequenting a large roost in south-central Indiana. In Louisiana reconnaissance was made of the area in which damage to rice by blackbirds occurs and a conference was held with interested persons. Only minor assistance could be extended in this case, as the handling of a general campaign against a bird destructive over most of the rice-growing area is beyond the present available resources of the Biological Survey.

SURVEYS OF FEEDING GROUNDS OF GAME BIRDS

The regular work included surveys of numerous lakes and marshes in Minnesota, Wisconsin, and Michigan used as feeding grounds by migratory game birds. Other work of the same general nature was carried on in Arkansas, Illinois, and Louisiana. In all cases reports on the surveys, together with recommendations for improvement in conditions, were made to interested individuals, officials, or organizations.

Especial attention was given during the year to obtaining data on drained areas. Reports indicate that some of the drainage operations have resulted unsatisfactorily so far as yielding lands suitable for agriculture is concerned. The Biological Survey is keenly interested in such matters, for the lakes and marshes are extremely valuable national assets from the viewpoint of recreation, not to speak of their importance in the original state as resorts for wild fowl and fur bearers. In this line of work the following drainage projects were inspected during the year: Mud, Thief, and Roseau Lakes, in Minnesota; the Horicon Marshes, in Wisconsin; and the Kankakee Marshes, in Indiana and Illinois.

A survey of the food resources for game birds was made also on Sapelo and Blackbeard Islands, off the coast of Georgia, and a report prepared recommending improvements. This is the locality where a cooperative introduction of Central American game birds is being made.

EXAMINATION OF STOMACHS OF BIRDS

In the course of the year the contents of 1,785 bird stomachs and of 209 owl pellets were examined. The groups most numerously represented by the stomach analyses were English sparrows, hawks, and shorebirds. As in former years, a number of special examinations were undertaken for correspondents of the bureau, the most noteworthy of which were of stomachs of woodpeckers, destructive to cacao in the Dominican Republic; hawks, from Arkansas and New York; owl pellets, from Pennsylvania; snow geese, from Quebec; black swifts, from the State of Washington; American mergansers and golden-eyes, the former guilty and the latter suspected of devouring trout in Michigan; and a miscellaneous collection of fruit-eating birds, chiefly robins and cedar waxwings, from Oregon.

COOPERATIVE STUDY OF QUAIL

In the region between Thomasville, Ga., and Tallahassee, Fla., are numerous large estates, the winter homes of sportsmen, among whom quail shooting is a leading recreation. Factors affecting the abundance of the birds have not been well understood, and this fact, together with a desire to maintain the maximum number of quail on the land, led to the contribution by groups of property owners, headed by W. S. Thompson, chairman of their committee, of a liberal fund available for three years, with which the Biological Survey could make a thorough investigation of the life history of the quail and of all factors affecting the abundance of the species. Two assistants have been employed for this work and a laboratory established at Beachton, Grady County, Ga., near the Florida line.

Numerous birds have been trapped and banded, so that information on the movements and longevity of individual quail will be obtained, as well as data on pairing habits, the make-up and permanency of coveys, and the like. A careful study is being made of the nesting of the quail, including character of site, range in number of eggs, destruction of nests by various agencies, and the net production. The relation of all natural enemies to quail will be specially studied, and emphasis will be placed also on food investigations, including possibilities of increasing the supply. Opportunity is afforded by the present investigation for making the most complete

study of life history that has ever been made of an American game bird, and numerous interesting and valuable results are confidently expected.

MISCELLANEOUS INVESTIGATIONS

An exhaustive study of the relations of the colony of white pelicans to fishes and the fishing industry at Pyramid Lake, Nev., had been under way a month and a half at the close of the fiscal year. It is being continued, and the bureau is confident that the data obtained will make clear what policy should be followed in regard to this much-criticized community of birds.

A trip of inspection of leading game farms was made to points in Illinois, Massachusetts, New York, and Pennsylvania with a view of learning the present status of the industry and of obtaining information and photographs for use in publications on the subject.

Tabulation was made of reports of game breeders holding permits for the propagation and sale of migratory wild fowl. This was based on about 90 per cent of the 1922 permits. There were 4,291 holders of permits, and they reared approximately 42,800 birds, of which about 12,200 were sold for propagating purposes and for decoys and 10,100 for food, while 8,000 were eaten at home.

A section on game poultry was contributed to an article for the 1924 Yearbook on poultry, and one on the relation of wild life to land values to an article on land policies in the 1923 Yearbook.

The manuscript for a new bird-house bulletin, entitled "Homes for Birds," was prepared for publication, as well as one relating to the economic status of a group of shorebirds—the woodcock, snipe, dowitcher, and knot. The manuscript of a bulletin on the magpie was revised. Two publications were issued during the year—Department Bulletin No. 1196, "Food and Economic Relations of North American Grebes," and Miscellaneous Circular No. 13, "Local Names of Migratory Game Birds," and at the end of the year a report was in press on the food habits of some winter-bird visitants (Department Bulletin No. 1249).

Concerning the laboratory work, it may be said that, as usual, the reference collections were built up to a higher standard of efficiency, and at the same time important transfers of material were made to the United States National Museum. Large numbers of notes on the food of birds have been extracted from periodicals and from other sources, and the file of reference pamphlets has been considerably augmented.

Examination of the stomachs of mammals was continued in a minor way, 113, chiefly of shrews and moles, having been analyzed.

FOOD HABITS OF REPTILES AND AMPHIBIANS

The study of the economic relations of American toads was notably advanced during the year by the examination of 1,001 stomachs, representing 12 species. A few reptile stomachs were examined and incidental to the other work reports were made for correspondents and members of the Biological Survey on special collections of reptiles and amphibians from Alabama, Arizona, New Mexico, Guatemala, Honduras, Panama, and Colombia. Important additions were made to the files of information on the food habits, life histories, and nomenclature of reptiles and amphibians.

BIOLOGICAL INVESTIGATIONS

The technical scientific investigations of the bureau have continued throughout the year. A large number of specimens of birds and mammals have been submitted for comparison and identification by scientific or educational institutions and individuals from all parts of the country. In addition the bureau has received a large number of applications from other governmental departments or bureaus, State officials, scientific and educational institutions, and others for technical information on the wild bird, mammal, and other vertebrate life of North America, and many requests for information concerning species in various parts of the world. Although these demands require the time of specialists to furnish the necessary information, it is considered a highly desirable public service. In regard to all forms of wild life the Biological Survey is being looked upon more and more by the public, as well as the Government service, as a dependable source of information not only as to the technical characteristics of the various species but as to their habits, distribution, and economic relations.

The information files of the bureau now contain 1,500,000 cards in addition to a great mass of original manuscript matter on the birds, mammals, reptiles, and amphibians of North America, and with the great study collections of these vertebrates gathered during many years of field work,

they furnish an unequaled store of information available to the public. The information in these files has come from a variety of sources, and their value can scarcely be overestimated. Without them it would be impossible effectively to conduct the administration of the bureau.

The gradual growth of the study series of birds maintained by the bureau had exceeded the accommodations to a point that rendered its use for reference extremely difficult. As a consequence, the collection was completely rearranged, new cases supplied for expansion, and a card catalogue of it completed. The collection, which is constantly being referred to in the preparation of reports and in supplying information to correspondents, is now more readily accessible.

Among other services to the public during the year has been the supplying to associations and individuals of information concerning the distribution of game and other birds and the requirements essential to their maintenance and increase under the legal protection now accorded them.

TECHNICAL STUDIES OF MAMMALS

During the year work progressed well on a monograph of the ground squirrels of the genus *Citellus* and related genera. This is one of the groups which exist in such abundance over great areas in the western United States that they are among our most serious animal pests, destroying millions of dollars annually in crops and forage. In addition, they are known to be carriers of the bubonic plague. It is important, therefore, that we should have definite knowledge of the existing species of these animals and the distribution of each, since through such information they can be more intelligently controlled, in case of a serious outbreak of the plague or some other disease transmittable through them. It is obvious that a technical knowledge of the species of rodents and of their distribution and habits is of the utmost practical importance in view of the information we have obtained during the past few years of their very direct relationship to crop and other plant production, including reforestation.

There was in press at the end of the year a revision of the pikas (*Ochotona*) (North American Fauna No. 47), and a technical study of "Individual and Age Variation in *Microtus montanus yosemite*" (Journal of Agricultural Research).

A technical monograph was completed on chipmunks (*Tamias* and *Eutamias*) of North America, and a monograph approaching completion will treat the shrews (*Sorex* and other genera), a group of small, largely insectivorous mammals, which include in their number the smallest known species of mammal. Progress has also been made in the preparation of a revision of the kangaroo rats of the genera *Dipodomys* and *Microdipodops*, which have a marked effect in reducing the carrying capacity of stock ranges, and in some localities are injurious to grain crops.

BIOLOGICAL SURVEYS OF STATES

Owing to a limitation of funds, field work in biological surveys of States was confined to Arizona. In that State a representative of the bureau with an assistant spent a large part of the summer mainly in working a number of the isolated mountain ranges in the southeastern part, with a trip into the Hualapai Mountains at the end of the season. This completes the field work of the life-zone survey in Arizona, and the data are now available for the preparation of the final reports.

Progress was made in the preparation of reports on surveys already completed in other States, including one on the mammals of Oregon. Reports on the birds and mammals of Washington and on the birds of Florida and North Dakota are well advanced. Completed manuscripts on the mammals of New Mexico and North Dakota and on the birds of New Mexico and Texas are awaiting publication.

The manuscript on the birds of Alabama, resulting from a life-zone survey of that State, was published during the year in cooperation with the department of game and fisheries of Alabama. Efforts are being made to enlist the cooperation of other States in the publication of similar reports already completed by the bureau.

MIGRATION OF BIRDS

About 125 volunteer observers, scattered over a large part of the country, contributed reports on bird migration. Fortunately many of these were from cooperators who have made similar reports during many consecutive years, thus adding records of the highest value, since they are continuous notes taken at the same place during successive seasons. Such reports show

seasonal variations and thus afford data which, as a whole, represent average conditions. These migration observations are of the utmost value in determining the seasonal movements of birds and are of direct practical service in connection with the establishment of open and close hunting seasons for migratory wild fowl.

BIRD CENSUSES

Another form of local bird records is afforded by the enumerations of birds breeding in selected areas, usually occupied farm lands, including orchards and farm buildings. These bird censuses, taken during the nesting season, indicate the abundance of resident bird life under average country conditions. About 75 observers sent in such reports during the year. Many censuses were taken on areas similarly covered during past seasons, thus giving an opportunity to note seasonal or other local changes which may have occurred. During the year Department Bulletin No. 1165 was issued, containing a summary of the data reported by cooperators in this work from 1916 to 1920, inclusive, being complementary to earlier reports on this subject.

BIRD BANDING

The banding of migratory and other birds for the purpose of studying their seasonal and local movements and of gathering other information concerning their habits has made notable progress during the year. The voluntary cooperators in this study now number 971, as against 851 the previous year. Of these, 81 are located in Canada. The large percentage of cooperators remaining in the work from year to year is gratifying, as it not only shows a sustained interest in the investigation but at the same time supplies information from specific locations through a period of years, which is more valuable than if limited to a single season. That a knowledge of the species of birds is of prime importance to those engaged in bird banding is obvious, as without it they can not accurately identify the species on which they place the bands, and every effort is made to maintain a high average of efficiency among the cooperators, who are doing so much to add to our knowledge of bird life. The birds banded during the year number 40,432, a large increase over the preceding year. The number of returns of banded birds, not including those repeatedly taken in the same trap, was nearly 2,000. Details of 100 species recovered, of which 13 were ducks, will be published shortly in Department Bulletin No. 1268, "Returns from Banded Birds, 1920 to 1923," in press at the close of the year. The information concerning the routes followed and rapidity of travel of banded birds gives us facts of prime importance in connection with the administration of the migratory bird treaty act.

During the year two new bird-banding associations were organized; one to cover the territory inclusive of New York and thence south, and the other as a chapter of the Cooper Ornithological Club to coordinate the work of bird banding from the Pacific coast eastward to the Rocky Mountain region. There is little doubt that these new organizations will have the same effect as those previously organized in developing increased interest in the work in the territory they cover. Definite investigations are encouraged by regional associations according to the special opportunities of their territories. This unquestionably adds to the attractiveness of the work and at the same time develops desirable special information. One association specialized during the present year in the banding of black-crowned night herons; another concentrated on gulls and terns.

With the assistance of a cooperator a representative of the bureau the last of July, 1923, banded a large number of gulls and terns in breeding colonies of these birds near St. James, Mich. During February an investigation on the occurrence and habits of mourning doves, with a view to developing methods of capturing and banding these birds in considerable numbers, was made in the vicinity of Thomasville, Ga. Representatives of the bureau made a number of addresses before local organizations and associations concerning bird banding. The establishment of trapping stations has been encouraged and mimeographed communications have been distributed to cooperators with a view to developing the possibilities of the work to the utmost.

A circular of the department (Miscellaneous Circular No. 18), "Instructions for Banding Birds," was issued and generally distributed during the year for the purpose of developing uniformity of effort in banding along lines which have proved most effective.

EXPEDITION TO THE DELTA OF THE YUKON

About the middle of February a cooperative expedition was dispatched to the great breeding grounds of migratory wild fowl lying immediately south of the Yukon Delta. The purposes of this trip were to gather as much information as practicable concerning the numbers and breeding habits of the geese, ducks, and other species frequenting that area, and later in the season, after the birds had molted their flight feathers, to band as many as possible in order to give some clue to the wintering grounds in the United States of the wild fowl which breed on the shores of Bering Sea. To reach these remote breeding grounds the party proceeded by steamer and rail to Nenana, on the Tanana River, about 65 miles from Fairbanks, Alaska, and thence a party of four traveled with two dog sleds a distance of about 800 miles to the point of their operations near the head of Hooper Bay, which was reached about the time the birds were arriving on their breeding grounds. The party found a great abundance and variety of birds and were very successful in securing the material and information desired during the breeding season. Banding operations were not undertaken until after the close of the period covered by this report.

It is believed that before thoroughly adequate efforts can be made to maintain our supply of migratory wild fowl it will be necessary to conduct banding operations on a considerable scale on the great breeding grounds of wild fowl in both Alaska and northern Canada. When this is done and the banded birds are taken during their migrations and in their winter homes direct relationship will be revealed between the various breeding and wintering grounds of birds, and necessary special protection may be afforded to areas where it appears to be needed. Research has been continued to obtain additional information affecting the increase of wild fowl, particularly as regards their breeding and migration.

CONFERENCES ON CONSERVATION OF WILD LIFE

Along with other educational work of the bureau, that of having representatives take part in meetings having to do with the conservation of wild life has continued. The most notable of these was the Conference on Outdoor Recreation called by the President in Washington May 22 to 24, 1924.

A representative of the bureau was present throughout the annual session of the American School of Wild Life Protection, at McGregor, Iowa, where lectures were given on conservation and on the harmful effects of the excessive draining of lakes and marshes. In connection with these conservation activities visits were made to other points in Iowa, Nebraska, Colorado, and Illinois, where wild-life refuges and parks were visited and conferences held with State and local officials.

Representatives of the bureau also attended the Fourth National Conference of State Parks, at Gettysburg, Pa., May 26 to 28, during which several parks in that region were visited and data obtained on the work being done by the State in connection with the conservation of wild life and the promotion of the public health and recreation.

In July, on request, an expert of the bureau visited Swan Lake, in Minnesota, an important breeding place for several species of wild fowl. This was in connection with efforts of the State game commission to prevent drainage of this important wild-life resort. An examination of the lake showed that little change had taken place in the fauna and flora since it was originally surveyed by the bureau in 1917. The evidence obtained by the representatives of the bureau was presented to the court as a part of the State's case in defending this area from drainage. It is gratifying to record that the decision of the court was against the draining of this lake.

GAME IN NATIONAL FORESTS AND NATIONAL PARKS

Early in September, 1923, a brief visit was made to the Grand Canyon National Game Preserve, in Arizona, where additional information was obtained concerning the rapidly increasing number of deer in this area and the forage conditions. During the last part of May, 1924, an examination was made of game and forage conditions on the National Bison Range. Conditions were found to demonstrate the fact that this range has become overstocked. There is urgent need of a reduction in the number of game animals there, and cross-fencing and corrals should be established in order that the game herds may be handled advantageously in utilizing forage to the best advantage and to maintain the game herds up to the carrying capacity of the range. In May and

June, at the request of and in cooperation with the U. S. Forest Service and the National Park Service, the bureau participated in an investigation of the forage conditions affecting the northern elk herds of the Yellowstone National Park and adjacent national forests. The purpose was to gather information which would develop a better utilization of the winter forage available for elk on the Gallatin National Forest and other areas in that region. These investigations will be continued with a view to assisting in the better conservation of the elk herds there.

ACCLIMATIZATION OF TROPICAL GAME BIRDS

Through funds provided by Howard E. Coffin, a cooperator of the bureau, a naturalist was sent to the Lake Peten region in Guatemala in 1923 for the purpose of securing a number of ocellated turkeys, curassows, and tinamous. These were to be placed on Sapelo Island, on the coast of Georgia, where it was hoped that conditions might be favorable for their increase. The ocellated turkey particularly will become a wonderful addition to our domestic fowls if it can be successfully acclimatized. More than 40 chachalacas were taken in Tamaulipas, Mexico, and placed on Sapelo Island. In the fall five ocellated turkeys and a number of curassows and large tinamous were brought to the island from Guatemala. Unfortunately, some of these birds perished through one cause or another soon after they were liberated. Later all the remaining turkeys died. Further funds were provided and the naturalist returned to the Lake Peten region to obtain additional stock. Gratifying reports have been received to the effect that some of the chachalacas nested on Sapelo Island during the spring of 1924.

HABITS OF RODENTS

An assistant was occupied from July to October in northern Michigan studying the life habits of various wild mammals—especially the beaver—and their relation to agriculture and forestry. In addition to making field observations he brought to Washington living examples of several small species for detailed studies of their breeding and other habits, including food preferences. A report was published during the year on "Breeding, Feeding, and Other Life Habits of Meadow Mice (*Microtus*)," in the Journal of Agricultural Research.

Observations have continued on the fenced quadrats established several years ago in Arizona to determine quantitatively the damage wrought by prairie dogs and other rodents on the stock ranges. The conclusions obtained from this source have been very striking. The value of these studies is obvious and it is desirable that the experiments be continued. A preliminary report will be available shortly as Department Bulletin No. 1227, "Damage to Range Grasses by the Zuni Prairie Dog."

At the request of the Forest Service a definite study has been undertaken of the relations of rodents to the forests and to reforestation in the yellow-pine region of the high table-lands and mountain slopes of northern Arizona. Experience in that region has shown that a definite knowledge of the various species of rodents and their habits, and practical methods for their control, must be gained before successful reforestation can be carried on.

Intensive field and laboratory studies and experiments have been continued in regard to several species of rodents peculiar to the northwest coast region in Washington, with special reference to their relations to agriculture, horticulture, and forestry. Progress has also been made in a special study which is being conducted in southern Arizona of the relation of jack rabbits to agriculture and the forage production on the open ranges.

ALASKA REINDEER

With the development of the reindeer investigations it has become plain that much larger and more suitable quarters, including sheds and corrals for the animals and buildings for the laboratory and living accommodations of the members of the staff, must be made available before the important investigational work of the bureau for the aid of the reindeer industry can be fully effective. Inquiries are being conducted in various parts of the reindeer territory to determine what location offers the best facilities for the principal reindeer experimental station.

In addition to studies of diseases and parasites which can be undertaken at such a station, feeding experiments to determine the comparative nutritive values of different types of native forage on the ranges are greatly needed. A knowledge of them is essential in connection with the

establishment of grazing allotments to herd owners. In addition, more extensive experiments are desirable to determine fully the value of feeding grain to reindeer used for hauling passengers and freight. The initial experiments of this kind, although made under great difficulties at Nome, indicate very clearly that there are great possibilities for utilizing reindeer instead of dogs in communicating with reindeer herds and in transporting supplies. Not only will the utilization of these animals be convenient to herd owners but it will result in a marked reduction in cost for such services.

Studies of the abundance and distribution of forage plants to determine the carrying capacity of ranges have been continued. At the same time observations of quadrats have been continued to determine the rate of reproduction of lichens and other forage plants. The results of these studies and of the ranges indicate that from 45 to 60 acres of range will be needed to carry each reindeer through the year. Information gathered appears to indicate that a burned-over range may require from 15 to 30 years to re-cover. A study of lichens on quadrats indicates a reproduction growth of from one-eighth to one-half inch a year.

POISON PLANT PROBLEMS

During the past two years losses from poison among reindeer, mainly fawns, have been reported among herds on the Kobuk River and on the Kuskokwim. Investigations appear to indicate that the branched *Equisetum*, or "horsetail," might be responsible, as the areas where the losses occurred proved to be wet, marshy ground where there was a vigorous growth of *Equisetum* in advance of the other vegetation. Some of these plants, as well as some monkshood, dried and fed to reindeer later as hay, failed to show any ill effect.

HERD MANAGEMENT

Reindeer herds were visited from Point Barrow, the northernmost point on the Arctic Circle, to Nunivak Island in Bering Sea, the opportunity in every case being taken advantage of by bureau representatives to explain to the herd owners improved methods of herd management. This educational work is appreciated by the owners, whether they be Eskimos, Laplanders, or Americans. During the summer of 1923 the experimental station power schooner *Hazel* traveled more than 2,500 miles in this work.

Among other practical results of our educational campaign has been the establishment of 10 corrals, which are in use in different places for handling reindeer, and instead of following the old, destructive methods seven other herd owners are planning to build corrals in the near future.

Studies of measurements and comparative growth of reindeer indicate that steers are at the most profitable marketing stage when 3 years old. Spotted and white reindeer average smaller than uniformly dark-colored animals, and in many herds are being eliminated from the breeding stock.

NUMBER OF REINDEER IN ALASKA

No accurate count of the reindeer herds owned by Eskimos and many of the others is practicable until corrals are in general use. Estimates based partly on counts giving a working approximation of the numbers in 66 herds have been made, and, using these as a check against the estimates of other herds, it is believed that in the year 1923 the number of reindeer in Alaska totaled about 241,000. The increase each year runs from 33 to 45 per cent of the total number of animals in the herd. This percentage can be increased by more careful herd management. Through the educational work of this bureau some of the Eskimos owning small numbers of reindeer are uniting them in community herds. One group of 72 owners, located near Shaktolik and Bonanza, have made a cooperative herd of 6,000 animals, and 68 owners at Council and White Mountain have formed a community herd of about 4,000. By handling these herds as units the percentage allotment of the increased expenses can be greatly reduced and the ownership of the animals brought to a more businesslike footing, with a much better chance of profitable results to the natives. This kind of management is especially necessary in connection with the marketing of surplus animals.

MARKETING FACILITIES

Two American companies are now operating refrigerating plants to receive reindeer carcasses for the purpose of shipping them to markets in the United States through Seattle. One of these operates refrigerating barges which can move from one point to another, mainly in the rivers, and the other company has several small

cold-storage plants along the coast, the number of which will be increased. Only about 90 tons of reindeer meat was shipped from the Territory in 1923, but it is anticipated that from this time forward there will be a rapid increase in the shipments.

PREDATORY ANIMALS AND REINDEER

It is reported that the Kobuk reindeer herds have been losing about 200 animals a year from the depredations of wolves. Lynxes are said to kill a few animals and red foxes occasionally kill a fawn. Reports have been received of occasional inroads of grizzly bears among the herds; however, the loss from this source has been small except through the demoralization and scattering of the herds through fright.

AID TO SHIPWRECKED CREWS

Following a terrific storm in the Bering Strait region last September, in which numerous small trading vessels were caught, the reindeer station schooner *Hazel*, the only boat available at Nome, was sent out as a relief ship. On September 24 the *Hazel* returned to Nome from Bering Strait bringing 19 passengers from the storm-bound boats at Teller, including members of a United States Geological Survey party and the crew of the wrecked schooner *Woods*.

CARIBOU

Investigations of Alaskan wild caribou have been continued for the double purpose of determining the status of these valuable game animals and at the same time supplying the necessary information which will enable the bureau to secure young bulls for breeding experiments in selected reindeer herds.

PROTECTION OF ALASKA LAND FUR ANIMALS

Progress has been made during the year in the work of protecting land fur-bearing animals, although handicapped by an inadequate law and lack of funds to maintain a sufficient warden force. The educational work conducted by the bureau's wardens in Alaska is showing results in a most substantial way, and there is a gratifying growth of sentiment throughout the Territory for better conservation of the fur resources.

By new regulations affecting fur animals, promulgated May 20 and effective July 1, 1924, the close season on beaver was continued, and in addition a close season was placed on marten. From reports received it was evident that martens were becoming scarce in districts where formerly abundant, and a close season was urged by Alaskans, including some fur traders, in order to give the animals a chance to increase. There was a like condition regarding beavers and it was deemed advisable to continue protection of these animals through another trapping season.

It is now unlawful to trap any land fur-bearing animal, except wolves, in the drainage of the Taku River between the Canadian boundary and a line drawn from Taku Point to the east end of Taku Glacier. This regulation was made in view of the fact that under new regulations promulgated for the protection of game in certain localities in Alaska that region practically had been made a game refuge—principally in order to give protection to a small number of moose there.

Fur warden service was established at Flat and Ketchikan in addition to that already maintained at Nome, Fairbanks, Anchorage, Unalaska, Cordova, and Belkofsky, and continued cooperation has been splendidly rendered by the Treasury Department through its customs service and by agents of the Department of Justice. As a result there have been comparatively few serious violations of the fur law and regulations, a condition which speaks well for the inhabitants, a large majority of whom believe in properly conserving the animals, which are such a valuable asset to them in helping provide their livelihood.

PROSECUTIONS AND SEIZURES

Seizures totaling 1,815 skins were made during the year, a few because they were unprime, but in the main because they were trapped out of season. Of these skins, 66 were of beaver, 1,749 muskrat, 2 red fox, and 1 mink. In only two cases have proceedings been instituted. These involved the seizure of 1,399 muskrat skins at Nenana, and will come up for trial at the fall term of Federal court at Fairbanks. No attempts to prosecute other violators were made, inasmuch as the parties from whom seizures were made willingly signed releases to the Government, and the loss of the furs with a warning as to illegal trapping was considered sufficient for the first minor offenses.

SHIPMENTS OF ALASKA FURS

Shipments of furs from the Territory, covering the period December 1, 1922, to November 30, 1923, as reported by postmasters and agents of transportation companies, indicate that the fur industry continues an important one. The number and value of skins shipped show a slight increase over the previous year. A total of 396,369 skins, valued at $1,702,000, were exported. These, together with skins brought out of the Territory by travelers and by vessels not reporting them, and skins of blue and white foxes from the Pribilof Islands, which come under the jurisdiction of the Bureau of Fisheries, will bring the total value of fur exports to more than $2,000,000.

The number of the principal pelts and their value were as follows:

Number and value of the principal pelts shipped from Alaska during the year December 1, 1922, to November 30, 1923

Kind of fur	Number	Value
Muskrat	319,611	$367,552
White fox	7,051	296,142
Beaver	14,341	258,138
Red fox	10,787	215,740
Mink	20,668	165,344
Marten	6,726	154,698
Blue fox	830	83,000
Silver-gray fox	252	44,100
Otter	1,781	35,620
Cross fox	993	29,790
Lynx	1,385	26,315
Weasel (ermine)	10,276	9,248

GENERAL ACTIVITIES

Continued patrolling of the waters and streams of southeastern Alaska with the bureau's seagoing power boat *Sea Otter* in the protection of land fur bearers, in addition to enabling wardens to visit important trapping sections and assist in educational work among natives in the conservation of wild life in general, has had a tendency to keep down violations to a minimum. It was possible also while patrol work was carried on to visit fur farms and give practical assistance to fur farmers.

FUR FARMING IN ALASKA

All but 1 of the 10 islands lying off the southern coast of the Territory, and under the jurisdiction of the bureau, have been re-leased to the present holders for a term of three years at the same rental as before. Reports indicate that lessees are meeting with fair success in their operations, and all are optimistic as to the future.

Interest in blue-fox farming continues to increase, many inquiries regarding the industry coming from people in the States. With continued growth of the industry all islands suited to it will shortly be occupied by reliable fur farmers, provided that legislation is enacted by Congress to give them proper protection. At present there is no authority for leasing many islands along the southern coast outside of Government reservations nor of issuing permits for fur-farming purposes there.

There are now a total of 212 fur farms in operation in the Territory. Both blue and silver foxes are being reared, and on some of the smaller fur farms attempts also are being made to propagate such smaller fur bearers as the mink, marten, muskrat, and beaver. Of the total number of fox farms 119 are on islands in southeastern Alaska, 31 in the Prince William Sound region, 14 in the Kodiak-Afognak region, 13 on islands off the coast of the Alaska Peninsula, 9 in the Cook Inlet region, and 26 on islands within the Aleutian Islands Reservation. Two new associations of fox farmers have been organized, one with headquarters at Cordova, the Cook Inlet Silver and Blue Fox Breeders' Association, and another, the Southwestern Alaska Blue Fox and Fur Farmers' Association, with headquarters at Kodiak. This makes four such organizations in southern Alaska.

Applications for permits to capture alive for propagating purposes such fur bearers as beaver, marten, mink, and muskrat continue to be received. A total of 21 were issued this year. These are granted to responsible parties, to whom all possible encouragement is given to try experiments with these fur bearers in captivity. Seven special permits to capture foxes for propagating purposes have also been issued, a majority of them being for white foxes in the northern part of the Territory, where attempts will be made to rear these animals in captivity.

PROTECTION OF ALASKAN GAME

An important piece of legislation affecting the enforcement of the Alaska game laws, enacted by Congress and approved by the President June 7, 1924, transfers the administration of the Alaska game law from the governor of the Territory to the Secretary of Agriculture, including $20,000 ap-

propriated to the Department of the Interior for enforcing the law. By this act the dual warden force in the Territory hitherto existing will end, and one force, known as United States game wardens, operating under one chief Alaska game warden, will enforce both the game laws and the laws relating to land fur-bearing animals. This change, effective July 1, 1924, will greatly increase the efficiency of the warden service as a whole and prevent duplications in assignment.

PREDATORY ANIMAL CONTROL

Work undertaken during the preceding year for the destruction of wolves, which have been preying upon game and fur animals on islands in southeastern Alaska, was continued. An experienced hunter was again assigned to investigate conditions and destroy wolves. Additional information of interest was gathered and a number of wolves were killed by use of traps and poisons. The practicability of destroying wolves on these islands whenever funds are available for the purpose has been fully established, and a marked scarcity of these animals was noticeable, doubtless due to the operations last year of the bureau's predatory animal inspector.

GAME AND BIRD RESERVATIONS

Increase in the public appreciation of the worth of game refuges as a means of protecting and perpetuating our wild life is demonstrated by the steady demand for inclusion in refuges of this kind of land needed for breeding and feeding areas for birds and mammals. As an example of this interest may be mentioned a communication from the Commissioner of Light Houses requesting the cooperation of this bureau in an examination of several lighthouse reservations in Lake Erie, Lake Huron, and Lake Superior to determine whether they included areas which were worthy of having bird refuges established upon them. At the same time the number of State wild-life refuges is rapidly increasing.

Survey of antelope.—Some years ago the American bison or buffalo was reduced from the untold millions once existing on this continent to a few hundred survivors in the northern Rocky Mountain region. The American Bison Society was organized and steps taken which have resulted in the reestablishment of these animals on a scale which has eliminated the danger which threatened them. At the present time the American antelope, one of our most beautiful and interesting large game animals, stands in danger of the fate which threatened the buffalo. For several years conservationists have been interested in these animals and various suggestions have been made for their conservation in different parts of the West.

During the past two years the Biological Survey has been conducting a census to ascertain the numbers in various States and the location of the herds. This has been completed and shows that there are approximately 25,000 of these animals surviving in North America, by far the greater number of which are within the United States.

In order to get an expression of the sentiment in regard to the conservation of these animals, the Chief of the Biological Survey called an antelope conference to be held at the National Museum in Washington on December 14, 1923. This was attended by conservationists from all parts of the country. The status of the antelope as shown by the census recently completed was brought to their attention and a discussion was held as to what might be done to perpetuate these animals. The principal conservation organizations of the country were represented and a general agreement was reached as to cooperation in conservation work in favor of these animals, with the Biological Survey to serve as the source of information concerning conditions in the various parts of the country where these animals occur and to assist in the work.

Antelope in Nevada.—During the year the Governor of Nevada requested the cooperation of the Biological Survey in locating and establishing antelope reserves along the northern border of the State. This request was met and the refuges were established. Later these were enlarged so that now about 5,000,000 acres are included in the Nevada State game refuges with between 3,000 and 4,000 antelope ranging in them.

The Biological Survey and the Permanent Wild Life Protection Fund in cooperation will mark the boundaries of the two great antelope refuges established in northern Nevada, on which in the spring of 1923 there were estimated to be a total of about 3,000 antelope.

In cooperation with the American Bison Society and the National Association of Audubon Societies movements were begun for the establish-

ment of national game refuges in Lake County, Oreg., and Owyhee County, Idaho, to protect antelope and sage hens, but not receiving unanimous local approval the matter has been held in abeyance for further consideration.

In the spring of 1923 the Governor of Nevada granted the Biological Survey the privilege of capturing 40 young antelope on the Washoe State Game Refuge in the northwestern part of that State, which was believed to contain at that time about 2,000 antelope. One of the predatory animal hunters of the bureau has a ranch in the midst of this refuge and he with assistants was detailed to capture the antelope immediately after they were born. The 40 animals were captured without difficulty and were being raised successfully on milk from bottles. Funds for securing these antelope were donated by Dr. E. E. Brownell, of San Francisco, and Dr. W. T. Hornaday, from the Permanent Wild Life Protection Fund. It is planned to place 12 of these animals at Hermit Basin in the Grand Canyon National Park in Colorado, and to divide the others between the Niobrara Game Refuge in Nebraska and the National Bison Range in Montana.

Other new refuges.—Near the end of the session of Congress, in June, 1923, a bill was passed authorizing an appropriation of $1,500,000 for the purchase of bottom lands along the upper Mississippi River to establish a refuge for birds and other wild life and fish. This should become one of the greatest and most important refuges in the country. While important for bird and mammal life, it is even more vitally necessary for the welfare of black bass and other fish.

Blackbeard Island, at the entrance of Sapelo Sound, Ga., was again made a bird refuge under the jurisdiction of this department by Executive order of February 15, 1924. It is desired to use it as an experiment station for the acclimatization of certain game birds introduced from Mexico and Central America. Among these are ocellated turkeys, curassows, and chachalaccas.

BIG GAME RESERVATIONS

The winter of 1923–24, like the one before, was mild over every portion of the West, so that the winter losses of game were light and the young of the previous year came through with better than normal growth. In fact, the increase on the big game preserves has been so satisfactory in recent years that it has been found necessary to dispose of the surplus animals which can not be supported by the forage production of these areas.

For several years work has been in progress to extend the game fence of the Niobrara Reservation in Nebraska to include 4,000 acres of additional pasture. This was completed in June, 1923, and the buffalo and elk which had heretofore been held in two comparatively small inclosures were moved into their new and very fine range.

Despite the war against predatory animals, a few antelope have been killed from the small surviving band at the Wind Cave Game Preserve in South Dakota. Every effort is being made to protect these animals through the services of a skilled predatory animal trapper. An attempt was also made to render the fenced pasture coyote-proof by placing stones along the ground at the bottom of the fence.

It may be added here that in this fenced refuge, and in the Bison Range in western Montana, the heavy losses of antelope have been in the face of a persistent warfare against predatory animals, during which hundreds of coyotes and other predatory animals have been killed. The danger arising from these animals is due to their ability to come in from great distances during storms and thus nullify the results of having cleaned up all such animals in the neighborhood.

The following tables show the number of big game animals on the refuges under the jurisdiction of this bureau:

Big-game animals on reservations maintained by the Biological Survey at the close of the calendar years from 1916 to 1924 (in 1924 to June 30 only)

Year	Buffalo	Elk	Antelope	Mule deer	White-tailed deer	Mountain sheep	Total
1916	206	165	47	2	3	-----	423
1917	251	205	57	2	6	-----	521
1918	311	261	55	15	8	-----	650
1919	381	345	54	21	9	-----	810
1920	431	433	65	27	5	-----	961
1921	508	519	91	54	21	-----	1,193
1922	603	[1] 608	21	[1] 52	[1] 31	15	1,330
1923	717	[1] 657	16	[1] 62	[1] 27	[1] 20	1,499
1924	866	[1] 843	7	[1] 82	[1] 31	28	1,857

[1] Estimated.

Distribution on June 30, 1924, of big-game animals on reservations maintained by the Biological Survey

Kind of game	Bison Range	Wind Cave	Niobrara	Sullys Hill
Buffalo	675	126	51	14
Elk	[1] 500	[1] 250	[1] 53	40
Antelope	-------	7	-------	-------
Deer, mule	[1] 80	2	-------	-------
Deer, white-tailed	[1] 25	-------	1	[1] 5
Mountain sheep	28	-------	-------	-------
Total	1,308	385	105	59

[1] Estimated.

National Bison Range, Mont.—The rapid increase of large game animals on the National Bison Range indicates that it is ideally suited to their requirements. The last of June, 1924, the range contained 675 buffalo, about 500 elk, 80 mule deer, 25 white-tailed deer, and 28 mountain sheep. The increase has been so unexpectedly great during the last two years that the range has become overstocked, and it became necessary the fall of 1923 to dispose of part of the surplus by killing some and disposing of the meat.

Fortunately, the following winter was mild and the grass on the range was available throughout the season. Notwithstanding this, however, in April the buffalo and other game animals were thin, the deer appearing to be in the best condition. A dry, cold spring, with high winds, evaporated the surface moisture and retarded the growth of forage. Some of the best grasses had become completely dried before the first summer rains. In the spring about 400 buffalo were taken off the main range and held in a pasture in order to allow a good growth of forage on the range. These buffalo were fed from April 1 to June 15 an average of about 18½ pounds of alfalfa hay per day. This was about 10 pounds to the animal less than they would have eaten had it been available. They ate the hay readily, however, and gained in weight. The reproduction of forage on the range during the spring was disappointingly small.

The calf crop in the buffalo herd for the spring of 1923 amounted to about 100 on June 30. The losses of buffalo from the herd from natural causes during the year amounted to 3 bulls, 6 cows, and 8 calves. Twenty-nine bulls were killed and sold for meat.

Evidences of beaver work among the trees along Mission Creek indicates the presence of a number of these animals. The open winter and the dry spring were favorable for the pheasants and for the sharp-tailed grouse on the range. Many covies of young birds were seen.

Very few coyotes have been noted on the range since early in 1923, although occasionally tracks were observed and howls of the animals heard within the refuge. One of the Government trappers did considerable work within the inclosure and caught a number of animals. It is believed that they have now been thoroughly eliminated, but they are continually coming in from a distance, so that never-ending vigilance is needed to prevent their increasing and depleting the numbers of the game.

During the year some improvements were undertaken, including the building of a small barn at the assistant warden's quarters, two pens for corralling and feeding buffalo, and a half mile of fence on the east side of the range to inclose 20 acres, with a water front on Sabine Creek. In addition various current minor improvements and repairs to roads and buildings were made.

Wind Cave National Game Preserve, S. Dak.—The game animals on this refuge also have increased until they now number more than the forage limitations render desirable. In June there were located here 126 buffalo, about 250 elk, and 7 doe antelope. All the animals were in excellent condition, although the spring was late and severe weather conditions prevailed. Two bull buffalo were killed and disposed of and a bull and a cow died during the year. Eight surplus bull elk were killed and disposed of with the buffalo.

Early in 1923 a herd of 17 antelope were on this preserve, but at the end of the year only 7 remained. The losses were caused by predatory animals, despite the constant effort to control these pests through poisoning and trapping. Three coyotes were known to have gotten inside the fence. Two were poisoned within a few days and the third, not being seen after some time, was believed also to have been killed. The Government trapper employed on the range and in the surrounding country caught seven coyotes and four bobcats. He reports a few straggling animals in the surrounding country.

One of the striking circumstances connected with the destruction of antelope by predatory animals is their apparent helplessness, and particu-

larly the fact that predatory animals appear to kill adult males more readily than they do the females or the younger animals. This may be due to the habit many of the males have of wandering off by themselves.

The grouse on the preserve do not appear to be increasing, perhaps through unfavorable feed conditions brought about by the intensive browsing of shrub growth by the elk. Bobwhite quail were plentiful and five covies were known to be nesting in the spring of 1924 within hearing distance of the warden's headquarters. Winter feed for quail is important in this region. Three small fields of grain were sown for the benefit of these birds and of the grouse on the refuge, which helped carry them through the year. These plantings will be increased, and it is hoped will be helpful in increasing the number of birds.

The principal improvement on this refuge during the year was the installation of floodgates where the game fence crosses Cold Springs Creek. Trap corrals for capturing the game animals have been completed.

Winter Elk Refuge, Wyo.—During the summer and fall of 1923 about 784 tons of hay was harvested and stacked on the refuge. In addition, 179 tons were purchased from neighboring ranchers, and grazing rights were rented on 1,400 acres. The weather during the fall and early winter was very favorable to the elk, and so little snow fell during the hunting season that few of the animals came down from the Teton State Game Reserve. As a result a large number of hunters failed to kill their elk. The first band of 400 came down from the mountains and arrived at the refuge on December 11. The winter was so mild and the snowfall so light that throughout the winter elk were able to secure forage on the pasture land. The first two weeks in January the cold was severe, the temperature registering down to —31° F., followed by high winds and drifting snow. A few warm days the last of January and the first of February were followed by freezing weather, which crusted the snow and covered some of the fields in the valley with ice. As a result, the feeding of elk with hay on the refuge began on February 4.

During the first week about 1,800 were on the Germaine tract and 600 near the warden's headquarters. By the end of February approximately 3,800 elk were on the two feeding grounds, and about 1,000 animals on the foothills to the east. During the latter part of March this band came in to the refuge for feed, thus increasing the number to about 4,800 animals. This was about 1,200 more than were on the feeding grounds during the previous winter. The feeding period ended on April 9.

Approximately 565 tons of hay were used on the refuge during the winter and spring of 1924. Of this, 365 tons were harvested on the refuge and 200 tons were purchased by the State of Wyoming from neighboring ranchmen. There will be available for next winter 683 tons, in addition to 250 purchased by the State.

As a result of the open winter and favorable weather conditions, only 18 elk, including 3 calves, were found dead on the refuge and adjacent ranches, an extraordinary record. At the end of the feeding season in 1923, 4 cow elk were held in a large corral near the warden's headquarters, where 3 calves were born to them. Numerous tourists visited the refuge to see these animals, which later were released.

Some needed repairs have been made to the fences and headquarters buildings. The installation of a water system in the warden's house was a long-needed improvement.

Niobrara Reservation, Nebr.—The buffalo continued to thrive on the new pasture north of the Niobrara River, where they found forage throughout the season. Whenever considerable snow fell on the reservation the buffalo sought bare ridges, where they had no difficulty in finding food. This refuge contains 51 buffalo and 53 elk. Here, as in the other refuges, conditions appear to be favorable and the herds are increasing rapidly.

The predatory animal trapper assigned to this locality in November, 1923, remained until the following spring, during which period he caught 44 coyotes and 2 bobcats on the reservation and in the vicinity.

In the spring of 1924 a number of upland plover nested in the pasture and two pairs of quail located near the headquarters.

Sullys Hill Game Preserve, N. Dak.—In June, 1923, this small game preserve had 14 buffalo, 40 elk, and 5 deer, all of which were in fine condition. During the winter of 1923–24 nearly 40 tons of hay and straw were fed these animals. The heavy snow in this locality often buries the forage until much of it is inaccessible.

Considerable attention is being given by the warden on this refuge to stock-

ing it with birds. In June, 1924, there were 6 Canada geese, 13 mallard ducks, 3 wood ducks, and 1 golden-eye. Two pairs of golden-eyes nested in the boxes placed on the border of Sweetwater Lake on the refuge. This little lake, although surrounded by low woods, is frequented by a number of species of wild ducks during migration. Many nesting boxes have been placed about it and it is hoped that golden-eyes and wood ducks may make it their regular nesting place. About 50 Chinese pheasants are located on the refuge, where a number of them are nesting. Some of the increase has spread into the surrounding country.

This game refuge has an attractive grove within which lies Sweetwater Lake. Back of this rises Sullys Hill, the highest elevation in this neighborhood, from which is a beautiful view of Devils Lake and the surrounding country. This locality is a favorite resort and picnic ground for people of all this region. During July, 1923, more than 3,500 people visited the reservation; in August nearly 1,800; in September more than 1,100; from October to December more than 1,000; from January to May, nearly 300; and in June, about 1,100; a total of more than 9,000 during the year. These visitors are mainly residents of the surrounding region who find here their most attractive place for an outing.

Some additional improvements have been made on the hostess house. The entrance drive and gate have been finished and other small changes made which add to its attractiveness and convenience for visitors.

BIRD REFUGES

A total of 64 bird refuges are administered by the Biological Survey. These are located from Porto Rico to Chamisso Island near Kotzebue Sound on the Arctic coast of Alaska, and to the Hawaiian Islands. Some of these are celebrated breeding places for wild fowl and each breeding season are occupied by marvelous colonies of interesting species.

About the shore of Lake Malheur in eastern Oregon nest a great variety of wild fowl, including ducks, herons, and many others. On an island in Pyramid Lake, Nev., thousands of magnificent pelicans breed, and on Laysan Island, half way to Japan, hundreds of thousands of albatrosses and other beautiful sea birds rear their young.

The maintenance of these refuges is the principal insurance against the extermination of some of our most beautiful and attractive birds. Conditions at some of them may be mentioned.

Hawaiian Island Reservation.—In the spring and summer of 1923 an expedition was undertaken to Laysan Island to investigate conditions there and to destroy the domestic rabbits which had been introduced years before and had overrun this wonderful breeding place, nearly exterminating the vegetation. In the spring of 1924, through the courtesy of the Navy Department and the Bishop Museum at Honolulu, the warden of this reservation was enabled to visit the island and could find no traces of rabbits, indicating apparently the complete success of the efforts to eliminate these pests. The vegetation, which had been replanted by the party the year before, was coming on so well that apparently the island will again be partly clothed with plants and thus afford shelter to some of the species which can not survive without it.

Big Lake Bird Refuge, Ark.—A number of hollow-log nesting boxes were put in place here to add to the facilities for tree-nesting ducks. Three of them were promptly occupied by wood ducks. The low water and heavy growth of seed-producing plants produced favorable conditions and a large number of broods of ducks were hatched here the spring of 1924.

In the fall of 1923 the use of headlights on this lake was prohibited by regulation in order to prevent the disturbance of wild fowl there. As a consequence, during the spring and summer of 1923 the warden observed a notable increase in the number of frogs, which, through a heavy market demand for them, had been decreasing so long as the use of headlight hunting had been permitted. The drainage of surrounding land has also concentrated the frogs of this district more and more in the lake.

It is gratifying to note that the residents of the region about this refuge are coming more and more to appreciate its benefits to the community in providing a breeding place for the wild fowl which pass from it into the surrounding country and thus offer opportunities for sport.

Lake Malheur Bird Refuge in Eastern Oregon.—Owing to the extremely light snowfall during the winter of 1923–24 in the mountains at the headwaters of the stream supplying Lake Malheur, water was unusually low in the lake

in the spring and summer of 1924. The low water and extremely cold weather of spring interfered with the usual growth of cat-tails, rushes, and other plants. As a result the dry plants of last year's growth became a great fire hazard early in the spring. Although every precaution was taken by the warden, a fire occurred, causing heavy loss through the destruction of the plant growth over great areas used by the birds for nesting. It also destroyed quantities of hay on the adjoining meadows, a serious loss to the owners.

The dry season, however, appeared to be especially favorable to the long-billed curlew, a large number of which nested in the short-grass pastures adjoining the refuge. A large colony of black-necked stilts, which the warden had not before noted on this refuge, appeared in the spring of 1924 and reared their young, as did a large number of Canada geese. Many swans visited the lake during the spring before passing on to their breeding grounds farther north. Owing to the very low water the growth of wapato, or water potato, over much of the area where the swans usually feed will render conditions unsatisfactory for them the coming autumn.

Clear Lake Bird Refuge, Calif.—For some years a point of land on this bird refuge extending into Clear Lake has been invaded by sheep each spring and the vegetation destroyed. This rendered conditions very unfavorable for the breeding birds. In the spring of 1924 more than a mile of sheep-proof woven-wire fence was built across the neck of this point to exclude the sheep and permit the shrubs and other cover to grow sufficiently to accommodate the breeding birds.

This area is used extensively as a breeding place for large colonies of white pelicans, terns, and cormorants, as well as by geese and ducks. Observations on the effect this protection of plant growth will have in attracting birds will be of great interest. The fencing of this area will have another practical purpose as a check plot for observation of the administration of the adjacent forest land as to forage production in comparison with the adjacent grazed area.

Florida bird refuges.—During April and May, 1924, a visit to several bird refuges in Florida showed a marked decrease of some of the species of birds breeding there in preceding years But little trespassing appeared to have taken place, and the decrease of the birds appeared to be coincident with the decrease in their numbers in other parts of the State away from the refuges.

Interest is awakening in this State in the conservation of its wild life and it is hoped that sufficient areas may be safeguarded to permit the perpetuation on a considerable scale of the native birds of the State. Unfortunately the exceedingly great increase of winter visitors, with rapid development of automobile roads and the use of streams by motor boats, is unquestionably having a most adverse effect upon the wild life of Florida.

Pelican Island Bird Refuge, near Sebastian, in the Indian River, has been celebrated for many years as the breeding place for hundreds of pairs of brown pelicans. In 1922 the mangroves were cut away on the shore half a mile or more away from the island and two small houses built. This and the passage back and forth to them of motor boats appeared to affect the pelicans so that less than 100 nests on the point of the island farthest from the houses represented all the pelicans left there the spring of 1924. Word was received that a great increase of breeding pelicans had taken place on an island to the north in Mosquito Lagoon. Later when the young were partly grown this "rookery" was invaded and more than 1,200 of them, by actual count, were killed with clubs by unknown vandals.

MIGRATORY BIRD TREATY AND LACEY ACTS

The direct benefit to our migratory wild fowl supply resulting from the prohibition of spring shooting and the sale of game, with the establishment of reasonable and uniform bag limits for these birds, is becoming more and more generally appreciated throughout the country. Many who were originally greatly opposed to the law are now numbered among its strongest supporters.

Information continues to be received that ducks are now nesting in suitable areas in the Northern States in great numbers, where previous to the passage of the migratory bird treaty act the nesting birds were very few. An extraordinary increase in breeding black ducks is reported from the marshes of Maryland north to Maine, as well as in Canada. It has been reported also that the breeding of blue-wing teals in some of the western States has enormously increased.

Unfortunately, the funds available for the administration of the migratory bird treaty act permit the employment of only about 25 full-time Federal game wardens to enforce the law throughout the United States and Alaska. It is obviously impossible thoroughly to enforce the law with such an inadequate warden service. The case would be hopeless were it not for the friendly cooperation of State game commissions and of others interested in conservation. Despite every effort, however, there is a steady growth of violations of the migratory bird treaty act, involving hunting during close seasons, market hunting, shooting from powerboats and sailboats, and the killing of such protected species as wood ducks and swans.

The bureau continues to receive complaints of violations of the law from all parts of the country, sometimes couched in critical terms, but with its limited funds it is prevented in many instances from taking action. This is not only embarrassing to the bureau but has a serious effect, since so much apparent immunity assists in causing disrespect for the law. Should these increasing violations continue, they can not but have an adverse effect on the maintenance of our supply of migratory wild fowl.

DRAINAGE

Conservationists and sportsmen have been seriously disturbed over the increasing danger to the future of the migratory wild fowl, which has developed through the progress of drainage operations. As the population increases the demand for land for agricultural purposes increases correspondingly, and the destruction of each water area has a distinct effect on our supply of migratory wild fowl, fur bearers, and fishes.

The Biological Survey appreciates the fact that drainage operations are often desirable and that frequently the resulting lands made available are distinctly more valuable than was the original water area. At the same time the investigations of the bureau have shown conclusively that a vast amount of indiscriminate and ill-judged drainage has taken place whereby water areas have been destroyed with their attendant productiveness for the benefit of the public, to be replaced by worthless lands which remain unutilized, or if utilized are of little or no value. Such operations are expensive and in many cases involve serious direct losses to the owners and to the interests of the community.

During the year many water areas were drained and plans made to extend drainage activities. It is hoped that hereafter better consideration will be given to the relative value of water areas as producers of game, fur, and fish, and also to their recreational value.

Fortunately, some States have already legislated to regulate drainage enterprises. In certain of these, as in Iowa and Minnesota, effective work has been done to save some of the water areas. Nowhere, however, do the laws recognize the public value of water areas and the desirability of limitations on their drainage until after a proper survey has been made and their value from an agricultural point of view determined as compared with their value to the community as recreational centers and as producers of game birds, fur bearers, and fish.

The difficulties connected with conserving water areas are great and the States will be handicapped in alone meeting the situation. As a consequence the feeling has grown among conservationists and sportsmen that the Federal Government, having control of migratory birds, should aid in bringing about the conservation of water areas in order to help maintain the numbers of these birds.

As during several preceding years, the Biological Survey has continued its surveys of water areas with a view to obtaining definite information as to their values in relation to the maintenance of the supply of migratory wildfowl, fur animals, and fish. The information gained by these surveys is being drawn upon to assist in the development of conservation in the States as well as in the administration of the migratory bird treaty act and in carrying out the general conservation policies of the bureau.

COOPERATION

Throughout its administration of the migratory bird treaty act the Biological Survey has appreciated the vital need of the friendly cooperation of the State game services and of sportsmen's and other conservation organizations, in order that a sentiment might be built up throughout the country favorable to the observance of this law. It is a grateful task to acknowledge the indebtedness of the bureau for the continued friendly help it has received

from such sources. In view of the very limited amount of funds for the enforcement of the migratory bird treaty act, a large share of the effectiveness of its administration rests on such cooperation. Many single States have a larger fund for the administration of their game laws than is available for the Federal work covering the entire country.

MIGRATORY BIRD TREATY ACT ADVISORY BOARD

The 1923 meeting of the advisory board was held in Washington on December 13, with 19 of the 22 members present. The numerous recommendations for changes in the regulations received during the year were submitted and carefully considered by the board, whose advice and suggestions proved to be in complete harmony with the policies of the department and were very helpful to it in reaching its decisions. In this connection it is worthy of mention that there has always been the fullest cooperation between the Biological Survey and the advisory board. During this year only minor changes were made in the regulations involving the open seasons for mourning doves in Louisiana and Mississippi and waterfowl, coots, gallinules, and Wilson snipe in New York.

PERMITS TO KILL MIGRATORY BIRDS

A limited number of complaints continue to come in alleging serious injury to crops or other interests by migratory birds. Exercising his authority under regulation 10 of the migratory bird treaty act regulations, the Secretary issued an order permitting the director and employees of the department of conservation of Michigan to kill merganser ducks and great blue herons at any time within that State when found destroying valuable fish life in rivers, lakes, and streams. This order was based on the findings of investigations conducted by experts of the Biological Survey, which confirmed complaints received from Michigan that these birds in various localities were exceedingly destructive to trout, and were in fact depleting some of the trout streams. Such permits affecting only a small part of the range of the species involved have no serious effect on the total number of these birds.

It has been found that shrikes haunt the vicinity of bird-trapping stations where birds are caught for banding purposes and become exceedingly bold in attacking and killing birds that are caught in the traps. For this reason the Secretary has issued a permit for the killing of shrikes in the vicinity of bird-banding stations.

In California the band-tailed pigeon under protection has increased greatly in numbers, and as a result of repeated complaints authority has been granted to growers of small fruits in that State and members of their families and bona fide employees to kill these birds during the daylight hours from May 15 to July 31 each year when destroying cherries. Permits for this privilege must first be countersigned by the executive officer of the State board of fish and game commissioners or his authorized representative.

It is believed that by permitting a reasonable control of birds inflicting serious damage to crops or other interests respect for the migratory bird treaty act will be more generally maintained.

VIOLATIONS OF THE ACT

Eight hundred and three migratory bird treaty act cases were pending before the courts at the beginning of the fiscal year, and during the year 573 new cases were submitted for prosecution. Of these 1,376 cases, 596 prosecutions resulted in convictions, 26 were nolle prossed, in 2 the grand jury did not return true bills, 132 were dismissed, in 61 the jury returned a verdict of not guilty, in 27 prosecution was barred by the statute of limitations, leave to file an information was denied in 35 cases, 4 were closed by reason of the death of the accused, 3 were stricken from the dockets with leave to reinstate, and in 1 case a demurrer to an information was sustained. In addition 1 libel proceeding against 31 strands of aigrettes that had been offered for sale and 2 against swans unlawfully possessed were decided favorably to the Government. The remaining cases are still pending.

The total revenue from fines collected during the year in all cases amounted to $12 408.25, the fines ranging from $475 to $1 each. Defendants were also required to pay the costs in a number of cases, which in some instances equaled and in others exceeded the amount of the fine. About 96 other cases were reported by Federal wardens, which, on account of youthfulness of the accused, insufficient evidence, adequate fines having been imposed previously in State courts, or for various other reasons were not forwarded for prosecution. Violations of the State game laws being involved,

the evidence in many of these latter cases was transmitted to State game authorities for appropriate action. The revenue accruing to State game departments by reason of this cooperation was in excess of $10,000.

Convictions in Federal courts were distributed as follows: Alabama, 10; Arkansas, 26; California, 1; District of Columbia, 5; Florida, 20; Georgia, 52; Idaho, 9; Illinois, 54; Indiana, 29; Iowa, 39; Kansas, 5; Kentucky, 2; Louisiana, 10; Maine, 15; Maryland, 10; Massachusetts, 6; Michigan, 4; Minnesota, 33; Mississippi, 5; Missouri, 58; Montana, 4; Nebraska, 6; Nevada, 1; New Hampshire, 2; New Jersey, 7; North Carolina, 14; Ohio, 4; Oklahoma, 2; Oregon, 32; Pennsylvania, 3; Rhode Island, 3; South Carolina, 1; South Dakota, 27; Tennessee, 18; Texas, 18; Utah, 6; Virginia, 42; Washington, 11; West Virginia, 2.

Two offenders in Iowa charged with killing ducks during the close season, in addition to paying a fine of $300 each were required to serve 15 days in jail, while one violator arraigned in New Jersey for hunting wild ducks after sunset was sentenced on plea of guilty to 1 day in jail.

During the year migratory waterfowl plumage and specimens of mounted birds unlawfully killed or possessed, having a market value of about $3,000, were seized. Most of the migratory-game birds seized were donated to public hospitals or to public charitable institutions for use as food.

Fines ranging from $100 to $25 were imposed against many offenders for possessing ducks in storage during the close season, offering to sell aigrettes, selling ducks, purchasing ducks, hunting ducks from motor boats, exceeding the daily bag limit on waterfowl, and for other miscellaneous offenses.

The sixth and seventh convictions in Federal courts for hunting wild fowl from an airplane were obtained in the eastern district of Oklahoma on June 11, 1924, when two persons were fined $25 each for killing wild geese by this means; while the eighth conviction for similarly killing wild ducks was obtained in the Federal court for the western district of Washington on June 17, 1924, resulting in a like fine. Since the Federal law became effective 19 cases involving airplane hunting have been reported, 6 having been obtained during the past year, and of the whole number 8 resulted in convictions, as noted; in 2 true bills were not returned; 1 was dismissed, and 8 remain undisposed of. The terrifying effect of airplanes upon wild fowl is so great that if any general use should be made of them in hunting the result would be exceedingly disastrous. Probably no other single method of pursuit of these birds could parallel their deadly effect in reducing the number of wild fowl. For this reason all sportsmen and conservationists interested in the maintenance of our supply should interest themselves in securing and forwarding to the bureau accurate information concerning such violations of the law. This cooperation will be of the very greatest practical value in helping protect our wild-fowl supply and is much needed, owing to the small number of wardens we have to cover such a vast territory.

Among other cases of interest terminated during the year may be mentioned 1 in the District of Columbia for purchasing wild ducks, resulting in a fine of $125; 1 in Idaho for hunting ducks after sunset, fine $50; 4 in Iowa for killing and possessing ducks in close season, fine $100 each and costs; 1 in Maine, shipping partridges interstate in violation of State law and contrary to Federal regulations, $200; 3 in Michigan, selling ducks, $50 each; 4 in Minnesota, hunting ducks after sunset, $50 each; 1 in Missouri, hunting coots from powerboat, $100, and 1 for killing a duck in close season, $100 and costs; 6 in North Carolina, hunting ducks at night, $50 each; 1 in Rhode Island, killing sandpipers, $45; 1 in South Carolina, killing wood ducks, $50; 1 in Virginia, involving the shipment of more ducks than permitted in one week, $475; 1 in Virginia, killing brant in excess of daily limit, $50; and 1 in Washington, for offering to sell aigrettes, fine $100.

SCIENTIFIC-COLLECTING AND OTHER PERMITS

There were issued during the year 1,079 permits to collect migratory birds and their nests and eggs for scientific purposes. Of this number 165 were new permits, and 914 were renewals of permits expiring December 31, 1923; 567 were general permits, authorizing the taking of specimens of all migratory birds, and 512 were limited, authorizing the taking of nongame and insectivorous birds, and shorebirds during the open season on yellowlegs and other species.

Scientific-possession permits numbering 199, mainly for the use of taxidermists, were issued, including renewals of 191 which expired De-

cember 31, 1923. Special permits were issued to 77 persons, authorizing them to possess and transport, but not to sell, specimens of migratory birds found dead or accidentally killed.

Permits issued during the year to trap birds for banding purposes numbered 988. These included 98 permits issued from July 1 to December 31, 1923, and 890 issued from January 1 to June 30, 1924. The 890 represent the actual number of persons holding permits to trap birds for this purpose at the end of the fiscal year. Of these, 242 are new cooperators, while 648 held permits in previous years. The value of bird banding as a means of gathering accurate information concerning the travels of migratory birds is becoming more and more apparent.

Permits to the number of 116 were issued during the year to authorize the capture of migratory waterfowl for propagating purposes and 2,360 permits were issued authorizing the possession, purchase, sale, and transportation of migratory waterfowl and their eggs for propagating purposes. This number is made up of 831 new permits and 1,529 renewals.

There was an increase of 65 scientific-collecting permits over those issued during the previous fiscal year and an increase of 141 in the permits to trap birds for banding purposes. Permits to capture waterfowl for propagating purposes, or to take the eggs of waterfowl, show an increase of 25, while the regular propagating (possession and sale) permits show a decrease of 1,178. This decrease is due to an amendment of the regulations on April 10, 1923, providing that persons may, without a Federal permit, possess and transport for their own use live migratory waterfowl that they might then legally possess or thereafter lawfully acquire. It is interesting to note, however, that this decrease is confined to persons who have held permits for some years and that as an offset 831 permits were issued in 1924 to persons who had not previously held them.

Beginning with January 1, 1924, all permits are valid until revoked by the Secretary, so that the routine work of issuing renewals each year will hereafter be obviated. This will materially reduce the volume of work which has heretofore been necessary in this connection each year. Correspondence incident to the permit work has assumed larger proportions than heretofore, and has been much more difficult to handle because of the complicated questions involved. Infractions of the permit regulations have been few and of a minor character.

INTERSTATE COMMERCE IN GAME

No new Federal cases involving violations of the Lacey Act were reported for prosecution during the year, but of the cases previously reported, one terminated in a fine of $5, and seven were dismissed. Fifty-eight investigations were closed as the shipments were either legally made or it was impossible to obtain evidence of illegality.

The bureau rendered many States valuable aid in reporting to them 209 apparent violations of game or fur laws and in furnishing evidence upon which to base State prosecutions. In 81 cases closed in State courts based on information furnished by the bureau or in which the bureau assisted in completing the evidence, fines totaling $2,461.50 and costs amounting to $269.20 were assessed. A jail sentence of 30 days imposed upon a violator in North Dakota was suspended. In another of these cases 145 muskrat skins were seized and confiscated by State authority. The work of the United States game wardens in detecting illegal shipments of furs from the States is meeting the approval of the fur trade, which is interested in the elimination of such practices from the industry.

INFORMATION CONCERNING GAME LAWS

The annual summaries of laws relating to game (Farmers' Bulletin No. 1375) and to fur animals (Farmers' Bulletin No. 1387) for the season 1923–24, and a directory for 1923 of officials and organizations concerned with the protection of birds and game (Department Circular No. 298) were issued during the year, and at the close of the year the "Game Laws for the Season 1924–25" (Farmers' Bulletin No. 1444) was in press. In July, 1923, and in June, 1924, there were issued the annual posters on "Open Seasons for Game" (No. 42, for the season 1923–24, and No. 43, for the season 1924–25). These publications aid in the administration of laws relating to the taking and transporting of game and the information assembled tends toward a gradual uniformity in laws in areas which are found to be climatically similar.

HUNTING AND TRAPPING LICENSES

State laws requiring trappers of fur-bearing animals to take out licenses and to report on their catch, with closer regulation of the trapping period to the season when skins are prime, will be a great aid to maintaining the supply of fur bearers.

Returns from 27 States on the number of hunting licenses issued during the season of 1923–24 show an average increase of 2.5 per cent. If this ratio holds good throughout the country, as is believed to be the case, the number of licenses issued in 1923–24 should have totaled about 4,450,035, an increase of 108,537 over the previous year. The figures, by States, for the season 1922–23 are given in Table 735, on page 1198 of the Agricultural Yearbook for 1923.

IMPORTATION OF FOREIGN BIRDS AND MAMMALS

The importation of foreign birds and mammals, while showing a considerable increase over that of previous years, has not yet reached the maximum attained in 1913, prior to the World War. The number of permits issued during the year was 741, an increase of 169, and the number of shipments inspected increased from 222 to 232. Six additional permits were issued for the entry of 26 miscellaneous birds at Honolulu, Hawaii. The total number of birds imported was 409,810, of which 30,150 were entered without permits.

The permits for mammals included 4,871 foxes from Canada, a considerable increase over the number authorized to enter during any of the three previous years, viz, 2,756 in 1923, 2,064 in 1922, and 1,574 in 1921. The total number of foxes authorized during the four years was 11,265. These were practically all for fur-farming purposes and indicate the growth of this new industry in the United States.

The most notable mammal entering the country during the year was a gorilla, which arrived in New York in April, the third ever brought alive to America. It was exhibited during the spring in one of the principal circuses. The last gorilla brought to the United States was on exhibition in the New York Zoological Park, but lived only a short time. Among other rare mammals was a drill and a Brazza monkey (*Lasiopyga brazza*), several baboons and other African monkeys, and 11 different species of kangaroos, the latter entered in a single shipment from Australia.

New York and San Francisco still continue to be the principal ports of entry. Comparatively few entries are made at Boston, Philadelphia, or New Orleans. On the southern border, Brownsville, Laredo, and Eagle Pass, Tex., are the chief ports of entry of Mexican quail and parrots; Vanceboro, Me., and Detroit and Port Huron, Mich., for foxes from Canada; and Portal, N. Dak., and Buffalo, N. Y., for entries from western Canada.

On the Pacific coast there has been a marked increase in the receipts at Seattle and an equally marked decrease in the number of birds entered at San Francisco, where formerly large numbers of certain birds from the Orient, as Java sparrows, sociable finches, zebra finches, and other species of small value were imported. Comparatively few of these species are now brought in, presumably on account of the duty, although some birds of the same species are still imported by way of Europe through the port of New York.

Importations of game birds included 28,388 Mexican quail and 4,196 Hungarian partridges, but otherwise were small and comparatively unimportant, being chiefly a few bamboo partridges, pheasants, and waterfowl. The shipments of Hungarian partridges represented only about 11 per cent of the number brought in during 1914, when the interest in these birds was at its height. This year the birds were distributed to five States, two in the East and three in the West: Connecticut received 500; New Jersey, 1,380; Colorado, 420; Montana, 1,700; and Nevada, 100. It is noticeable that none of these States received any considerable number of quail, while those which were most anxious to secure quail were apparently not interested in restocking with Hungarian partridges.

About 1907 many of the State game administrations became interested in the Hungarian partridge. Importations were made during subsequent years both in this country and in Canada. Up to the present time all efforts to acclimatize these birds in the eastern part of the United States appear to have been failures, but on the other hand good success has been attained in eastern Oregon and Washington, and also in Saskatchewan and Alberta, Canada. This has encouraged the introduction of these birds in Nevada, Idaho, and Montana, the results of which are awaited with great interest.

Very few pheasants of any kind were imported—only a single shipment

of 100 ringnecks from England and a few aviary birds, including Reeves, Swinhoe, and Lady Amherst pheasants. As mentioned in the report last year, the importation of pheasants has not recovered since the war, and the stock of aviary birds is low compared with pre-war conditions. In fact, several species then represented in the larger collections probably no longer exist in the United States. Shipments of waterfowl were confined mainly to ornamental species imported for park or exhibition purposes.

Ten permits were issued for the entry of 204 eggs of game birds; the shipments covered by these permits were nearly all from one point in Alberta, Canada, and comprised chiefly eggs of ruffed grouse, sharp-tailed grouse, and canvasback ducks.

The principal cage birds imported, as usual, have been canaries and parrots, of which the canaries numbered 310,379 and the parrots 45,817. Among the parrots the most notable importations included considerable numbers of Cuban parrots and Australian shell parrakeets. Although neither of these birds were entered in as large numbers as before the war, the Cuban parrots numbered about 2,400 and the shell parrakeets more than 10,000. A number of rare species were represented in the entries, among which may be mentioned 2 keas from New Zealand; the Le Vaillant parrot (*Poicephalus gulielmi*) from Africa; the Bodin amazon (*Amazona bodini*) and the red-fronted Amazon (*A. salvini*) from tropical America; a short-tailed parrot (*Graydidasculus brachyurus*) from Brazil; 70 Pennant parrakeets (*Platycercus elegans*) from Australia, and South American parrakeets, including several hundred chocolate-faced parrakeets (*Conurus aeruginosus*) from Venezuela; and 30 cactus parrakeets (*C. cactorum*) and 47 half-moon parrakeets (*C. aureus*) from Brazil.

Among other rare birds were 2 kiwis from New Zealand; 6 wood hoopoes (*Irrisor erythrorhynchus*); 5 giant whydahs (*Diatropura progne*); 2 great ground hornbills (*Dichoceros bicornis*); 6 verditer flycatchers (*Stoparola melanops*); 6 Abyssinian starlings (*Spreo superbus*); and 400 bleeding-heart doves from the Philippines, the first large consignment of these doves which has been received for several years.

The tariff act of 1922 places an import duty of 50 cents each on all cage birds brought in valued at not more than $5 and 20 per cent ad valorem on birds of higher value. As a result there has been a marked falling off in the importation of weaver birds, particularly of Java sparrows, nuns of the genus *Munia*, strawberry finches, zebra finches, cordon bleus, and sociable finches. Such large numbers of low-priced species as were formerly imported are no longer brought in, although a few representatives of all of these forms are entered from time to time.

Traffic in certain native cage birds, as mockingbirds, cardinals, and other attractive song birds from Mexico, has formed the subject of frequent inquiries recently, owing to the general restriction on the possession and sale of these birds under State laws. Although possession may be authorized in some States, shipments of these birds are frequently resold, and thus find their way into States where the birds may be offered for sale inadvertently or otherwise contrary to local laws. Dealers and other purchasers in order to avoid possible difficulties should first learn the limitations, if any, concerning the possession of such birds under the State game laws.

IMPORTATION OF QUAIL FROM MEXICO

The entry of quail from Mexico last season was on an entirely different basis from that in any previous year, owing to the fact that the Mexican authorities required permits for the export of the birds, and these permits were issued only to a few authorized exporters and for limited numbers of birds. The cooperation of the Biological Survey was requested to see that the quota was not exceeded in importations at the border.

The total number of quail imported was 28,388, the largest number ever entered in any season except in 1922, when 37,953 were brought in. Most of the birds were entered at Brownsville, 1,993 at Laredo, and 4,794 at Eagle Pass. Importations began later and closed earlier than usual. Although the season extended from November 15 until April 30, both dates inclusive, the first shipment did not arrive until February 18 and the last shipments on April 21, so that the season of importations was only about two months. As usual, the consignments were examined at the port of entry, but no quail disease was reported during the season. The bulk of the birds were shipped to six States: New York, 3,032; Pennsylvania, 7,227; Maryland, 2,468; Kentucky, 5,158; Oklahoma, 5,383; and Texas, 3,176; and

the remainder—1,944—in small numbers to a dozen other States.

Quail have been regularly imported from Mexico for about 15 years, and the total number brought in up to date is 189,859. Most of these have been shipped to less than a dozen States—Massachusetts, Connecticut, New York, New Jersey, Pennsylvania, Maryland, Virginia, Ohio, Kentucky, Oklahoma, and Texas. The States which received 20,000 or more between 1921 and 1924 are Pennsylvania, Maryland, Kentucky, and Ohio.

A cooperative survey of the situation south of the Rio Grande, by Mexican authorities and the Biological Survey, has been proposed as a basis for collecting data to govern further importations. Under the system in force this year not only is the number of birds inadequate to meet the demand but much dissatisfaction and criticism was voiced in States which are unable to obtain the birds at the time and in the quantities they desire. This year for the first time under the system of export permits, the number consigned to each State was limited, but the apportionment was not always satisfactory, some States being able to obtain considerably more than others.

The system followed by the Biological Survey in the last few seasons of prompt inspection and passage across the border of importations of Mexican quail has resulted in greatly reducing the losses from disease among these birds, both during shipment and after their arrival at their destination. Furthermore, experience has proved that the importation and liberation of these birds during the spring months results in far greater success than efforts to bring them north earlier in the winter, when they must be held for long periods in confinement.

PUBLICATIONS AND INFORMATIONAL WORK

In addition to the publications prepared in the Biological Survey and issued during the year, or in press at the close of the year, there have been prepared in the bureau, or edited and authorized, many items for press distribution and a number of articles for scientific and popular periodicals dealing with timely activities of the bureau. Numerous photographic prints also have been selected and made from official negatives as requested to illustrate these and special articles by individual writers and for photogravure sections of the public press.

WASHINGTON : GOVERNMENT PRINTING OFFICE : 1924